SCIENTIFIC AMERICAN

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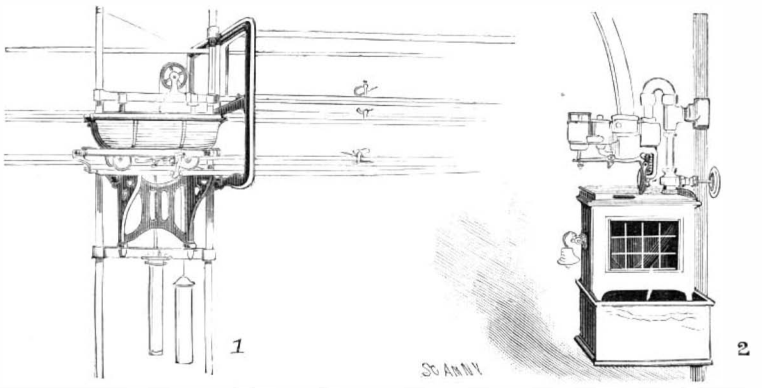

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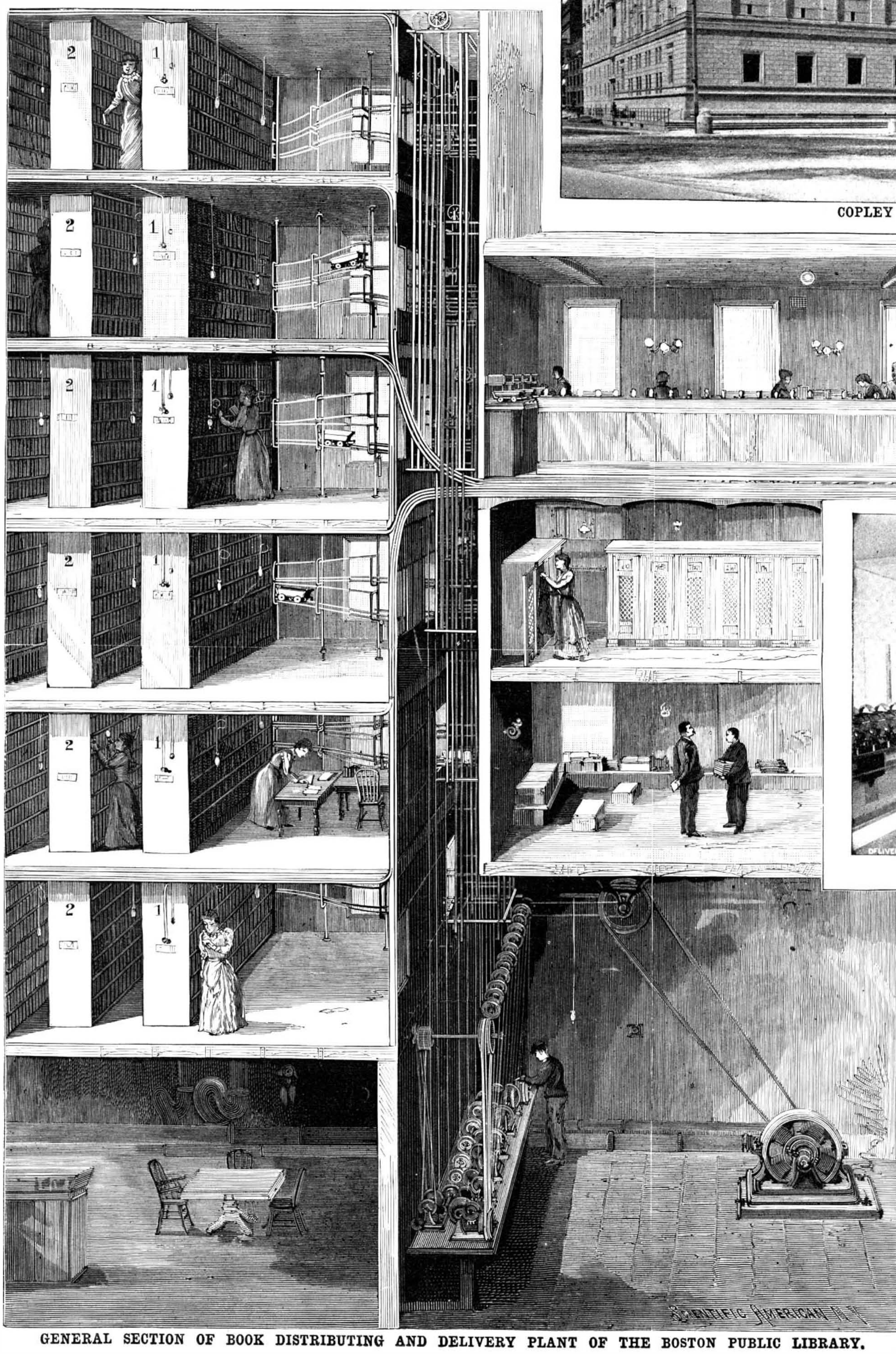

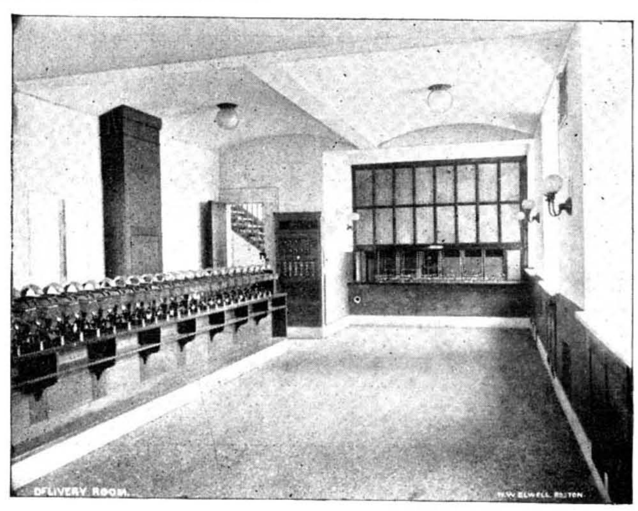

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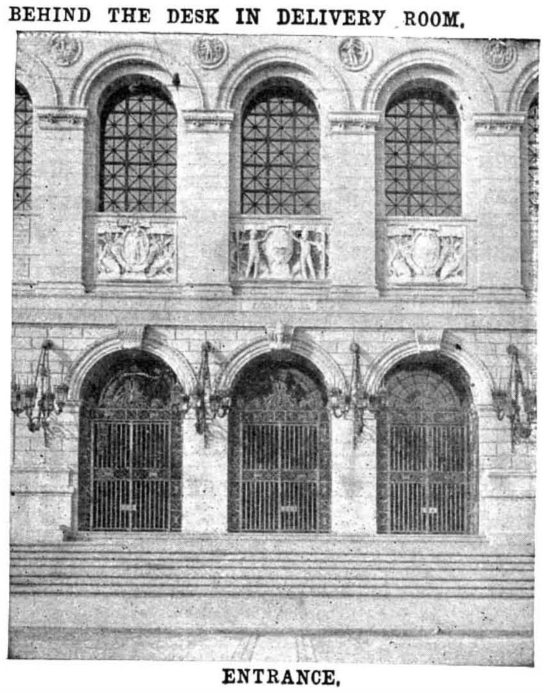

ENTRANCE.

THE BOSTON PUBLIC LIBRARY.—[See page 297.]

Scientific American.

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Contents.

(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 1036.

For the Week Ending November 9, 1895.

Price 10 cents. For sale by all newsdealers.

THE AUSTRALIAN ANTARCTIC EXPEDITION.

In the SCIENTIFIC AMERICAN SUPPLEMENT of September 21, 1895, we gave an account of the recent voyage of Mr. C. E. Borchgrevink to the Antarctic regions, which he undertook in the interest of science. In his paper, read before the International Geographical Congress, he advocated the sending of an expedition to Victoria Land for exploring purposes, and offered his personal services for such a voyage. A response to his suggestion has come from Australia, where the Premier of New South Wales has sent out an invitation to the other colonies to co-operate in fitting out an Antarctic exploring expedition. The proposition has been favorably received, the latest response coming from Queensland. South Australia has the matter under advisement, and will reply on receipt of the full details of the scheme. Tasmania has voluntarily offered her assistance.

The first efforts of the expedition will be directed to the exact location of the south magnetic pole. If the plan proposed by Mr. Borchgrevink be followed, a landing will be made at Cape Adare and a supply depot formed there. From this point the expedition will attempt to reach the magnetic pole by an overland route. If the calculations prove to be correct, it will be found to lie 160 miles to the southwest from Cape Adare.

EXHAUSTIVE STEAM BOILER EXPERIMENTS.

The issue of Engineering for September 20 contains an account, by Mr. Bryan Donkin, M.I.C.E., of twenty-one steam boiler experiments which have been carried out by Professor Kennedy and himself during the past five years. The paper is accompanied by tables and diagrams showing the results, and it is in every way a valuable contribution to this branch of mechanical engineering.

We note that in the column headed "Pounds of coal burned per square foot of grate per hour," the highest results are credited to a locomotive in active service that was fitted with a copper fire box. This amount, $35\frac{50}{100}$ pounds, is fully double the average results obtained on the grates of the other types that were tested. With the exception of a steam fire engine boiler, which burned $34\frac{30}{100}$ pounds, the other boilers average about 15 pounds per square foot per hour.

This comparison shows to what hard work a locomotive boiler is put. Under the head of "Equivalent water evaporated per pound of coal from and at 212° Fahr.," the Great Eastern locomotive again heads the list with the very fine record of 12·51 pounds.

Mr. Donkin is of the opinion, however, that priming took place on this trial of the locomotive, from the fact that the heat accounted for was 4 to 5 per cent in excess of the heat received. In such a case a certain amount of the 12·51 pounds of water was carried off in the solid form, and cannot justly be credited to the evaporative capacity of the boiler. This would place the Lancashire boiler in the first place with a record of 12.46 pounds.

It is remarkable that the fire engine boiler, with its high consumption of fuel per square foot of grate, shows the relatively small evaporation of $7\frac{95}{100}$ pounds of water; though this is in part accounted for by the fact of the small size of the boiler, and the fact that it was pushed very hard in the trial.

In the table of relative "thermal efficiency" the best result is shown by three Cornish boilers, in which the good average of $11\frac{40}{100}$ pounds of water evaporated per pound of coal was obtained with a consumption of $6\frac{86}{100}$ pounds of coal per square foot of grate. It is surprising to find that the two water tube boilers stand near the bottom of the list, being from fifteen to twenty per cent lower in efficiency than the Cornish and Lancashire boilers, and—if we include them in the comparison with a five per cent reduction—the Great Eastern Railway locomotive boilers. In the Cornish boilers the direction of the gases was through the one center tube, back along each side, and returning underneath the boiler to the chimney. The center tube was furnished with large cross tubes. The whole paper is extremely valuable, and it is of the kind that the mechanical engineer will carefully file away in his scrap-book for future reference.

CHROMATOPHORES, OR THE COLOR-BESTOWING CELLS OF ANIMALS.

The endless variety of coloring which is to be found in the animal kingdom, and which is a distinguishing characteristic of its lower forms, has been made the subject of elaborate and careful investigation. We are told that the published literature bearing on the subject of pigment cells, or chromatophores, is "enormous." Much of this literature is controversial, and the exact means by which nature presents such a rich variety of coloring in the animal world, the origin and functions of the cells to which are assigned the color-giving properties, are, even to-day, to some degree a matter of opinion among the specialists who have devoted themselves to this difficult, but very fascinating, study.

The October number of Science Progress contains an exhaustive article upon the above subject by Walter Garstang, M.A.

According to the writer, although the chromatophore is a cell whose essential function is one of color-giving, it appears that all color-giving cells are not chromatophores. Thus the cells of the sensory, respiratory or excretory tissues are pigmented; but their pigmentation is accidental, or, more strictly speaking, not essential. The cells that give the reddish hue to the tissue of the lips or the nostrils are not chromatophores. Their primary function is not one of coloration, but that of the chromatophore is.

"Chromatophores are pigmented cells specialized for the discharge of the chromatic function."

The only true pigment cells, as explained above, are those of vertebrata, of cephalopod and certain pteropod mollusca, and of crustacea.

The commonly accepted therory regarding the nature and origin of chromatophores is that they consist of connective tissue elements. Mr. Garstang, on the other hand, is of the opinion that they have arisen by the modification of "pre-existing pigmented cells;" and since their very existence involves the idea of visibility, there is here strong presumptive evidence that they originated in the outside layer of the body, or what is known as the ectoderm. This view is borne out by Joubin's description of the development of the chromatophore in the embryo of argonauta. He shows that the pigmented cell is "originally one of the constituent cells of the embryonic ectodermal epithelium. At an early stage it becomes slightly larger than its neighbors, and then sinks beneath the surface of the epithelium at the apex of a pit-like invagination of the ectoderm. It then enlarges greatly, detaches itself from the epithelial pit, and becomes surrounded by mecodermal cells, which transform themselves into the radial muscle cells. The ectodermal invagination closes up."

Very nearly akin to the above process is that of the development of the purple glands of Aplysia, described by Blochmann: "Each of the purple gland cells is at first a part of the ectodermal epithelium; it enlarges and sinks beneath the epithelium, retaining a narrow, neck-like prolongation to the surface; the whole of the cell then sinks deeper within the mesoderm. Each gland cell becomes surrounded by connective tissue cells and muscle cells, by the contraction of which the pigmented secretion of the gland is forced to the exterior."

The chromatophore has an elaborate system of nerve fibers which spring from the nerve system of the skin. In shape it might be described as a disk, sandwiched between two outlying "nerve plates." Referring to the pigment cells of mammals already mentioned, such as those of the respiratory organs, it is probable that they are "degenerate representatives" of the chromatophores of the lower orders of vertebrata. In the process of evolution, as the covering of hair began to develop and the chromatophoric effect was covered up, these cells would become useless and degenerate.

The coating of feathers in birds would presumably beget the same degeneracy of the chromatophores—and it has done so.

Entire degenerate pigment cells are to be found in the epidermis of anthropoid apes. There are no entire pigment cells in the epidermis of the negro, "only processes from sub-epidermal cells."

In the white races of man pigment cells are almost entirely absent.

The above considerations furnish a strong presumption that in the mammals at least the function of the pigment cells is not one of nutrition, as some naturalists have suggested, but merely one of coloration.

As his final conclusion the writer states that there is not "a single indubitable proof of the mecodermal origin of true chromatic cells;" he has been "led to the opinion that chromatophores" "are universally of ectodermal origin." That is to say, that they originated on the outside, and not beneath the skin of the body.

This conclusion is agreeable to the function of the chromatophore, to the exercise of which light is an absolute necessity.

To Reward Conductors and Motormen.

According to the Street Railway Journal, the Brooklyn Heights Company proposes to reduce expenses and obviate damage suits by offering handsome premiums for the faithful discharge of duty. For this purpose the board of directors has authorized the setting aside of the sum of $10.000 to be divided pro rata among all conductors and motormen who, until May 1, 1896, shall have had no accident causing either injury or damage to either persons or property, or to the company's property, and who have not been suspended for violation of the company's rules.

The management hopes by the payment of this amount to secure more efficient and conscientious service on the part of both conductors and motormen and thus improve the service of the company's lines.

Van Gestel's Travels Through New Guinea.

The only white man known to have crossed the island of New Guinea from shore to shore, to have actually traversed the vast unknown interior and seen the aboriginal Papuans face to face in their native forests, is Van Gestel.

"I started in 1874, from the mouth of the Fly River in the Gulf of Papua, on the south coast of New Guinea, to run the frontier line. There was talk at that time of the annexation of New Guinea by the government of Queensland, Australia, and so the Dutch government resolved to define its possessions. I entered Papua with a detachment of a hundred Dutch soldiers, in their tidy uniforms of light blue linen, and a band of as many coolies to carry supplies.

"The interior of New Guinea is one vast mass of upheaved granite, without traces of minerals or metal ores, the strata tilted and piled topsy-turvy. Everywhere the work of volcanic eruptions is to be seen. Such a thinly populated region, considering the fact that it was an absolutely new country and that fruits and small game were so plentiful, I did not suppose could exist. The natives we saw from time to time, at a distance mostly; they never molested us. Their heads were flat on top, with long, curly, black hair; they went entirely naked. Their buttocks extended out eight and even ten inches, this repulsive deformity constituting a fleshy support amply capable of sustaining a child in a sitting position. Nor was this their most marked peculiarity. Some of the nursing mothers threw their breasts back over their shoulders or under their arms, at will, to feed the infant carried in a sling between their shoulders.

"The Papuans are a very unattractive race to look upon. In arms they were primitive to a degree that was astounding. They had neither bows nor spears that I saw, their only weapons being stone hatchets. Of the use of metals they seemed to be entirely ignorant. In the dry season they made their homes in caves, which they found or excavated for themselves. Some of these cave dwellings I visited, discovering fragments of their repasts and occasionally a broken stone ax. In the rainy season they live high in the trees, where they build rude houses of sticks laid around and intertwined with the branches, thatched with dried alang-alang, and reached by shaky looking stick ladders.

"Most startling was the solitude, the destitution of life and motion, in the great central plateaus which we reached in our gradual ascent from the river level. There were plenty of small creatures of the squirrel tribe, some of the peculiar pig-headed deer we have in Java, and an occasional little tiger cat, rather handsome than hurtful looking. That was all. I saw in my whole journey, from the mouth of the Fly River on the southeast coast to Geelvink Bay on the northwest, not a single beast of prey, unless those pretty little spotted tree cats could be dignified by that name. Not a kangaroo of either the tree climbing or grass jumping variety was seen, nor any of the dingos or wild dogs elsewhere reported. I did see a number of specimens of the great bat called by the natives kalong or 'flying dog,' with its curious coat of light brown hair and its wing expanse of six feet—truly a formidable looking creature, but not hurtful as I found it.

"But of birds there is, I verily believe, a vaster profusion of more beautiful tints and delicate plumage in New Guinea than anywhere else in the world. They fairly flamed through those somber forests, which but for their bright hues and sharp cries would have been funereally suggestive. What a paradise the interior of New Guinea would be for a naturalist! From the great cebu, which devours stones, and the cassowary, through all the species of peafowl and the bird of paradise, down to the cockatoos and the wood pigeons, there were birds of beauty in never ceasing variety and numbers.

"At suitable stations along the route I had the soldiers nail up on trees the Dutch flag and iron charts of the Dutch coat of arms, on most of which no white man's eyes have since fallen. When we reached Geelvink Bay, and realized that our task was finished, and that Holland's part of New Guinea was so definitely determined then and thenceforth that no other nation could lay claim to it, we gave a rousing cheer, and it must have been music in the ears of the solitary post holder whom the government had even then for some years maintained on the coast. The poor fellow probably didn't see a friendly face more than half a dozen times a year. He lived in a block house, watching the coaling station for the Dutch war vessels in those waters."—Lippincott's Magazine.

The Olympic Games.

The Olympic games really began with horse racing and chariot racing, and the course at Olympia was nothing more than a hippodrome circle, with lines of seats around for the spectators. The horse and chariot racers from Elis flocked to Olympia by thousands. Other contests, such as foot racing, boxing, wrestling, throwing the discus, the dart and the javelin, jumping, etc., were introduced. The Olympic games had now become a great national festival, held every four years, called Olympiads, and such importance did they soon gain in the general Greek mind that they actually became an almanac or time table for Grecian history.

Athletics had now become more than a passion—a religion—with the Greeks; for at the beginning of every festival a sacrifice of some animal was made to Jupiter Olympus, and every contestant entered the list with his heart anxious for the favor of this supreme god. As fond as we moderns are of athletics, we can never hope to enjoy it with quite the enthusiasm the Greeks did. To do so we would have to carry that inspiration that we get from our Bibles, song books, and family altars to the race track with us. The Greeks were muscle mad, but it was the necessity of the times. The contestants trained long and arduously for these great festivals before leaving their homes, and then, a few weeks before the celebration, they set out with their horses, chariots, tents, etc., for Olympia. When the festivals were at the zenith of their glory, all the civilized world was there represented camping in tents about the sacred mount that overlooks the beautiful river Alpheus. Some historians—Pausanias, for instance—have estimated that there were nearly 200,000 spectators present.

The judges in the Olympic games were all chosen from citizens in Elis by lot. When the games were most popular there were nine judges, all Elisians. This is one of the strongest proofs that the Greeks were religiously honest in the conduct of these games. Modern nations certainly would not consent to let the judges in the games all be taken from one nation. When the judges had taken their seats in the judges' stand of the stadion, in the morning, heralds appeared, announcing the contestants to the vast concourse assembled.

The first contests were on the hippodrome with chariots and horses. The chariot races were contests between two, four, six, and sometimes more on the course at a time. Only wealthy persons could afford to enter chariots, as a chariot was an expensive piece of property. Many of the most distinguished statesmen and warriors, among them Alcibiades, the Blaine of Greece, entered their chariots in those races, and many women had their chariots entered here also. Horses, mules, and colts were raced in pairs, fours, sixes, etc. Often two horses were tied together and their riders raced them, sometimes one pulling the other headlong after him. The jockeys also practiced jumping from the horses at full speed on the course. There were also walking matches between the horses.

The next contests introduced at Olympia were boxing and wrestling, and then a combination of these two exercises. This was called the pancratium, and was the most violent of all the contests. These bouts usually followed the horse racing, the contestants entering the arena under the influence of inspiriting flute music, their bodies, nude as at birth, anointed with olive oil and sometimes sprinkled with dust. Men were often killed in this game, but the choking, beating, and hugging had to be concluded according to rules. If a contestant manifested any malice, put heel or toe or knuckles in the abdomen or eyes, it was sufficient to disgrace him, and caused him to be called off.

The pentathlon was a combination of five games: running, jumping, throwing the discus and the javelin, boxing, and wrestling, etc. The Greeks were very fond of foot racing, and hence the track was crowded and the running violent as possible. Their races often amounted to two or three miles, and the racers ran till their tongues lolled out of their mouths, and sometimes they fell dead before reaching the goal. They were undoubtedly very much better long distance runners than the moderns are, though it is very doubtful whether a Greek could beat the record-breaking American or Englishman in a hundred yard dash.

History is not clear on the details of the training, especially the dieting, of a Greek athlete. All the Greeks were very simple in their food. There were epicures, but no gourmets, gluttons, and Luculluses among them. They ate fish, olives, currants, a little beef, barley bread, and they drank wine, but were not drunkards, delirium tremens being unknown among them. Plato denounced the Olympic games on account of the high feeding and overtraining of the youths for weeks and months at a time; but in their diet some of the victors at Olympia lived on bread, lean meat and wine, with a few olives thrown in. The fact is, the Greek did not have to diet himself for a contest as a modern does. He was every day more or less ready for a contest. He took a cold bath, a thorough rubbing of the skin, and a good kneading of olive oil into his hide from the hands of a masseur, and then he was ready. After his exercises he took a hot bath. That was about all his preparation. But there were men then who denounced athletes as there are now. Among them were such immortal minds as Plato and Aristotle, and even Herodotus, the guileless father of history. Pindar has celebrated those games and their victors in a manner to make the contests immortal.

During the contests, we are told, the flutist piped his strains, and the athletes did their best—as much to be celebrated in his song as to receive an ovation from their friends on their return home. Phidias was there, too—that man whose equal with a chisel was never born; whose eye for pure form and its manifold meanings has never been surpassed. Doubtless he got many points for his immortal statues from the nude athletes moving unconsciously before him.

The Greek had a strange idea of woman's position at Olympia. He admitted the maidens to these festivals and excluded the mothers. Why he did so is not understood. But the Greek gave the maiden more liberty than he did the wife and mother, perhaps on the ground that maidenship itself is the strongest protection to a woman. At any rate, the maidens here looked on at their nude brothers in the arena, and there were many of them present.

If Hercules, Alcibiades, Pericles, Phidias, Pindar, and other notables could witness the exercises at Athens next year, they would be as greatly shocked as any of that modern crowd could be to witness there a literal reproduction of all the Olympian games, for most likely next year at Athens the cycle maiden in her bloomers will be seen in full bloom.—Illustrated American.

Cycle Notes.

In Russia bicycles are not carried in railroad carriages, unless they are entirely stripped of all luggage and tool bags.

The French Association for the Advancement of Science recently held its annual meeting at Bordeaux. At the 1894 meeting a paper was read by Dr. Championière on the subject of "Cycling," which attracted great attention. As if to put the advice then given into actual practice, a feature of the last meeting was an excursion of a party of the members, mounted on cycles, to Cubzac.

As touring is becoming more general every day, it may be interesting to know what formalities the touring cyclist has to perform in the different countries with regard to his machine. In Germany, Holland, Denmark and Luxemburg the cycle is permitted to enter free; also in France, unless this country is entered from the Belgian frontier, when, after September 1, a security of 35 francs has to be deposited. The following countries demand deposits, which are returnable when the tourist leaves the territory: Austria, £2; Spain, 70 pesetas per 100 kilos; in this country a pass for the machine, available for six months, can be obtained for about a shilling. In Italy the deposit amounts to 84 lire; in Portugal to 17 per cent on the value of the machine. Russia demands about £2 and Switzerland 200 francs per 100 kilos. In the latter country a pass for the cycle for six or twelve months is required, and machines must be provided with a leaden seal, which must remain intact until the cycle is taken out of the country. It is hoped that the endeavors of the touring clubs of France, Belgium and Italy will be successful, and that next year tourists' cycles will be permitted to enter free everywhere.—The Cyclist.

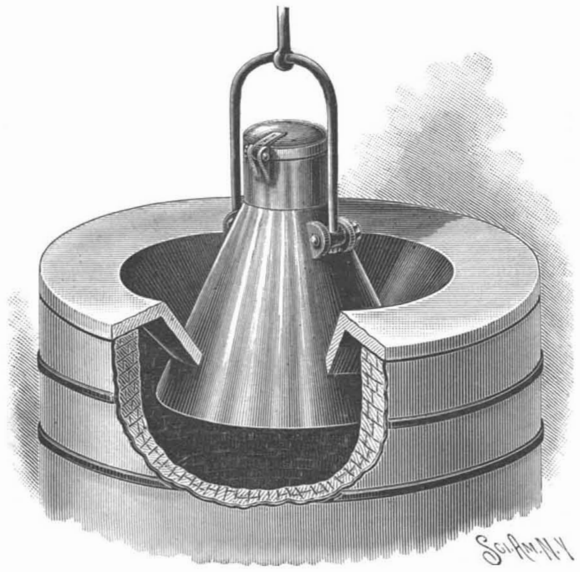
There is no occasion for a rider to be uneasy in his mind because his back wheel will not revolve, when lifted off the ground, as long as somebody else's. This test is a very indifferent guide to the comparative running qualities of two machines. One reason, of course, is that so much depends on the rigidity of the frame. No matter how freely a wheel revolves when no pressure is applied to the pedals, the machine will not run easily in actual use if the pressure on the pedals throws the chain wheel out of line, while any want of rigidity in the cranks, the chain or the spokes will also mean a loss of power. A poor chain, too, may run freely when loose, but not when power is applied. Then, again, the length of time a wheel will revolve when off the ground depends very much upon the weight of the tire and rim, and perhaps partly on the weight of the pedals. A wheel fitted with a light racing tire will not revolve as long as one fitted with a heavy roadster. But there is another reason, namely, that some of the forces which oppose the revolution of the wheel are increased by the weight of the rider in the saddle, while others are not. Suppose there are two machines, and the back wheel of neither of them will revolve freely; but in one case this is due to friction in the hub bearings, while in the other it is due to a leather gear case touching the spokes. The weight of the rider will make no difference to the pressure of the leather against the spokes, and this slight retarding force will be very little noticed in actual riding; but the friction in the bearings, being enormously increased by the rider's weight, will become a serious matter.—Scottish Cyclist.

The Katahdin's Trial.

The new harbor defense ram Katahdin had her official trial over the Long Island course October 31, and, although her actual time did not bring her time within the specified limit, it is confidently expected that allowances for currents will raise her average above the required seventeen knots.

A BELL FOR BLAST FURNACES.

To prevent damage to blast furnaces by the explosions which frequently occur in the top of the stack, from the ignition of accumulated gases, the improved bell represented in the accompanying illustration has been devised and patented by George B. Berger and Martin H. Thompson, of New Castle, Pa. The bell, seated in the hopper, has a perpendicular cylindrical extension at the top of which is an outwardly opening



BERGER AND THOMPSON'S BLAST FURNACE BELL.

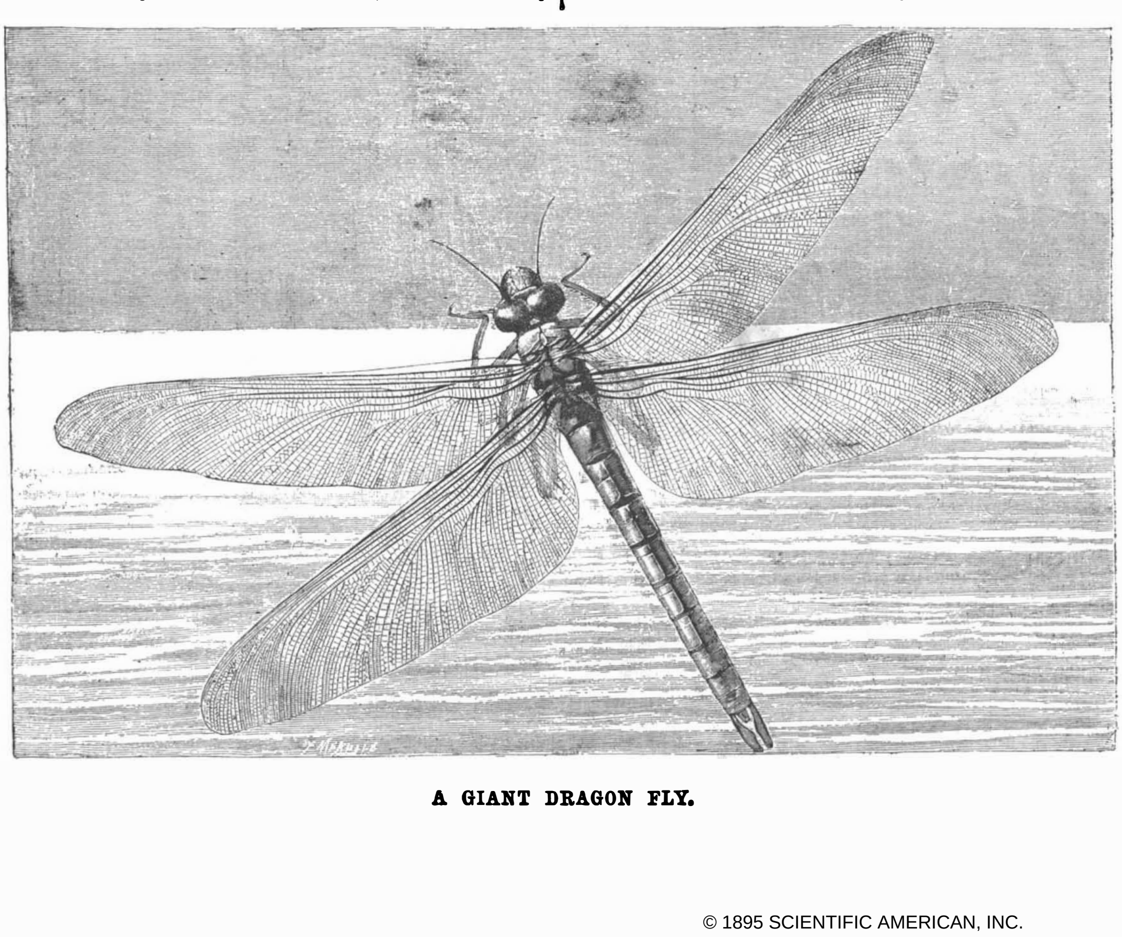
pivoted door or valve, which is adapted to be opened automatically by the force of accumulated gases or explosions. The bell extends approximately half its length above the top of the hopper when the bell is in closed position. and when the bell is in the lowermost position its upper cylindrical portion projects above the upper surface of the hopper, and all danger of the valve being clogged or affected by the contents of the hopper is avoided, the valve being thus free to operate at all times.

A GIANT OF FORMER AGES.

It is well known that everything on this earth is judged relatively. It is difficult to believe that turtles were once as large as elephants and that crocodiles walked on their hind legs and were 65 feet tall, although there are still turtles that are one and one-half yards long and crocodiles 22 feet long; and we are even more surprised to learn that certain dragon flies that lived in former ages measured 27 inches from tip to tip of the wings, because those of the present day are scarcely one-tenth as large. However, such insects really did exist when the coal was still green and soft, and the explorer Charles Brongniart has described fossils of them found in the mines of Commentry, in the Department of Allier, France. These, of course, were not exactly like the dragon flies of the present day, but were similar to them. Brongniart has called them protodonta, and those of our time are named odonta. He has found such fine specimens that the whole insect has been reconstructed.

Brongniart has found specimens of two different species, the large one already referred to, which he has named Meganeura monyi, for Mr. Mony, director general of the mine at Commentry; and one only about half as large, which he called selysii, for the Baron Selys Longchamps, of Luttich, the best authority on living dragon flies in Europe. The Meganeura monyi had a thick head, and colossally developed jaws that were provided with strong teeth; the eyes, like those of the present species, were large and round; the first of the three rings, the prothorax, was narrow, but the second and third rings, the mesothorax and metathorax, to which the two sets of wings were attached, were more fully developed; the legs were powerful and quite long, the hind legs being longer than the two other pairs; and the wings were very long, almost five times as long as wide.

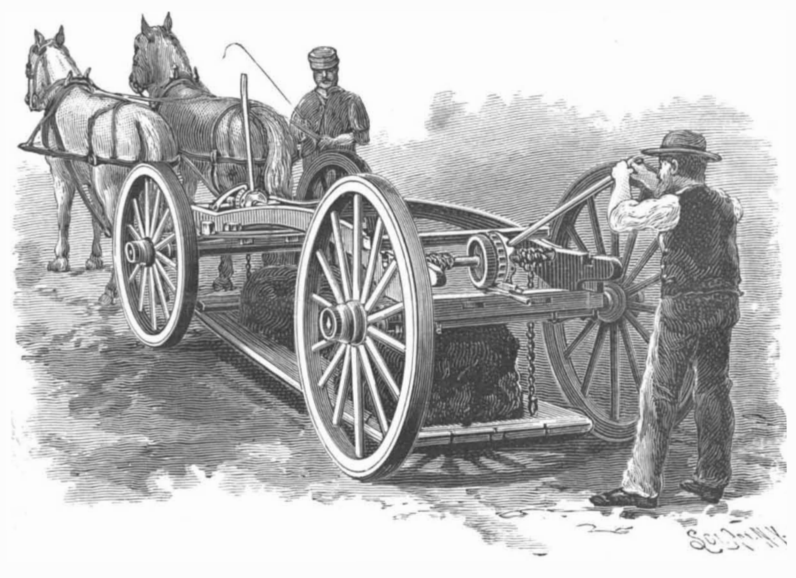
It would seem that the dragon flies of ancient times did not differ materially from those known to us, but, being so much larger and voracious, we can assume that the insects and fish which served as food for them, both in the larval state, under water, and as flies, must have been either very large or very numerous.—Illustrirte Zeitung.



A GIANT DRAGON FLY.

AN IMPROVEMENT ON THE STONE BOAT OR DRAG.

A machine designed to overcome the difficulty of lifting and loading stone, and facilitate its carriage, taking the place of the old-fashioned stone boat or drag, is represented in the accompanying illustration. It has been brought out by the S. C. Forsaith Machine Company, of Manchester, N. H., and is made in sizes suitable for one, two or four horses, capable of carrying two, four or eight tons. It consists of a strong four-wheeled truck with heavy axles and an improved arched reach, to which is attached a powerful and simple lifting mechanism and chains—a double hitch just in front of the rear axle, where the most weight naturally comes, and a single hitch back of the forward axle. The lifting appliances are independent of each other, and each is operated by one man by a lever with ratchet and pawl, holding the load securely at any point. The stone may be lifted and drawn over the boat until it is filled, and then it, with its load, may be lifted and drawn away. The machine may also be used as a stump puller, and as a hoist for loading long timber or logs.



THE BUTTERFIELD STONE LIFT.

An Experiment with Condensed Army Rations.

The federal government has been experimenting at its various military posts with condensed army rations, so called, with a view to using that style of regimen if it were found practicable. Whatever may have been the experience at the other military posts, that of Fort Logan has been of a kind to preclude the use of condensed army rations unless some decided, but scarcely anticipated, improvement is effected in that kind of food; the experiment was given a thorough trial, but it only resulted in incapacitating one-half of the men experimented upon from military duty, making them ill for several days.

Condensed army rations have been used by the European armies for some years, and, with a view to benefiting by them, the American military attachés at the European capitals were instructed to make inquiries concerning the rations, and to send the information obtained, including samples of condensed rations, to Washington. Then, after organizing a special board to have direction, the War Department entered upon the experiments which have been the source of woe to many.

The theory of condensed rations is, not that they shall serve the army as permanent food, but rather as provision to be taken along in an emergency. The condensed rations have less weight and bulk than the regular rations, but the prime desideratum was that the food should be serviceable in emergency cases, for expeditions of about four days' duration.

From the samples the attachés sent to Washington, as learned here, the stomachs of the European soldiery must be either indifferent as to what is put into them, or compulsion exacts submission to what is nothing short of barbaric cruelty. For instance, a sausage of bread and meat received from Germany quickly emptied a large room full of people because of its odor.

In September the experiment with condensed rations was tried at Fort Logan. A period of fair weather was chosen, and an expedition into the neighboring country of four days with fifteen mile marches was ordered for a company of the Seventh Infantry. The rations issued consisted of coffee, bean soup, bread and bacon. The coffee and soup were condensed into small tablets; the bread was crushed into a flat cake of the weight and hardness of a stone. The bacon was solidly packed in a tin can. The rations were the best obtainable, bought from reliable firms. The bacon came from Chicago, the coffee from a well known house in Detroit, the soup from San Francisco and the bread from Denver.

A tablet of soup and a can of bacon were supposed to last two meals, a cake of bread one meal. The tablet of coffee made a pint of that beverage. To make the coffee and soup, all that was necessary was to add the tablet to the required amount of boiled water. The bacon had to be fried, and the bread soaked in warm water and eaten as one would oatmeal, with some sort of dressing if obtainable.

The soldiers marched and ate as ordered, but their marching and eating were brought to an abrupt end by more than half falling sick before one-half the allotted time expired. With the first meal, men began to be taken ill with an aggravated stomach complaint; before the end of the second day more than thirty men were in the hospital, in the number being included most of the officers. The marches were abandoned, and a detail of those still unaffected was sent to the fort for dry tack—anything but the new food —and a surgeon. Some of the soldiers after reaching the fort did not recover for some days.

The report sent to the War Department at Washington is wholly against the experiment.—N. Y. Evening Post.

Wrought Iron Pipe Lines in the West.

The wrought iron riveted pipe line has for many years been in successful use in the West, more particularly in the hydraulic mining districts. Its toughness and elasticity and the thoroughly reliable nature of the material make wrought iron piping specially adapted to carrying water, at exceptionally high pressure, through the rough, mountainous mining districts of the West. Of late, moreover, it has completely ousted cast piping in the work of carrying city water supply from distant sources.

One of the latest instances of this is the line constructed from Alvarado to Oakland, California, a distance of 22 miles. The pipe, 30 inches in diameter, is made of the best American iron. It is double riveted, chipped, calked, and coated within and without with asphaltum. It was tested to 150 pounds pressure. The total time occupied in the manufacture and laying of the 22 miles of pipe was only seven months; and as an evidence of the excellent quality of the work, we are told that there was not a leak discovered in the whole length of the pipe when in position. The work was done by Francis Smith & Company, of 150 Beale Street, San Francisco.

POSTPONEMENT OF THE MOTOCYCLE RACE.

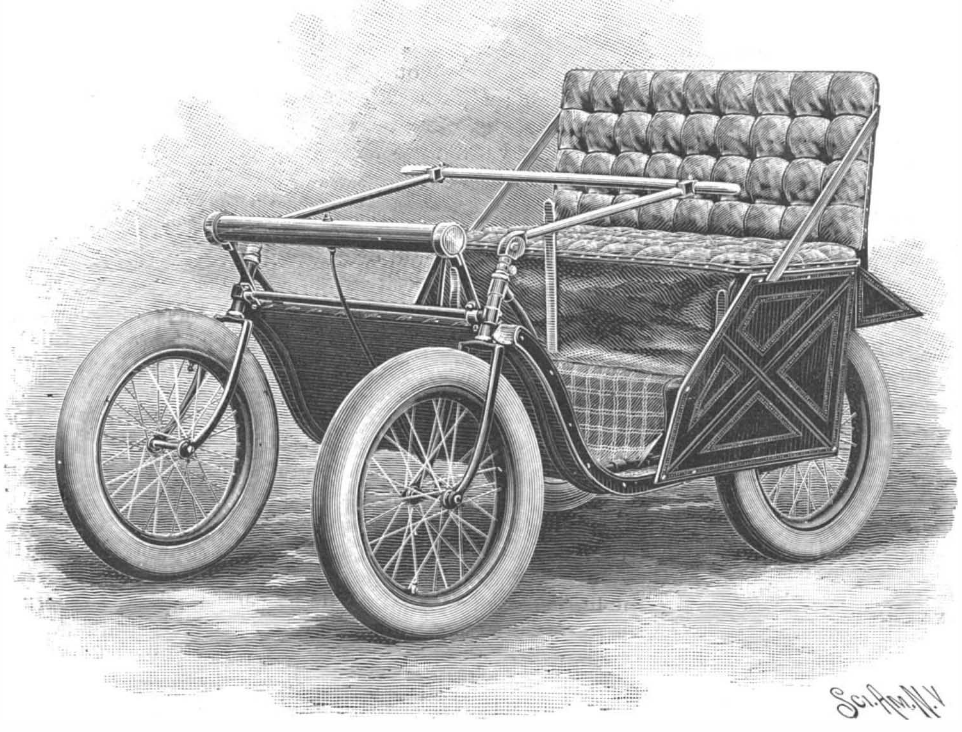
The motocycle contest, which was to have occurred November 2, was postponed on November 1 at a meeting of the judges until Thanksgiving Day, on account of the plea of American manufacturers and inventors that they had not sufficient time to get their new vehicles ready. There was however a race on Nov. 2 over the 92 mile course for a purse of $500. The carriages which ran belonged to the Duryea Motor Wagon Company, Springfield, Mass.; Kane & Pennington Company, Chicago, and the H. Mueller Manufacturing Company, Decatur, Ill.

The Mueller vehicle made the distance in 9 hours 30 minutes; the Kane-Pennington carriages dropped out of the race, and the Duryea machine broke down.

The Duryea carriage is made by the Duryea Motor Wagon Company, of Springfield, Mass. The Duryea wagon weighs about 700 pounds and is built for either two or four persons.

The one shown in the engraving is arranged for two people. It is driven by two three-horse power motors, which use ordinary stove gasoline, so that the expense of running is less than one-half cent a mile.

The wagons have a carrying capacity of eight gallons, so that they will run from 100 to 200 miles. The wagon needs recharging with water each day, and both the gasoline and water can be supplied to the wagon in five minutes. The object of the tank of water is, of course, to prevent the motor from overheating. It runs backward or forward with equal facility, and has four speeds, 5, 10, and 20 miles per hour forward and 3 miles backward. It can be geared to different speeds to suit the roads of any locality and may be run at any speed desired below its limit over roads over which ordinary traffic travels. The wheels of the carriage are 34 and 38 inches in diameter and are equipped with 2½ inch pneumatic tires, and it is easily governed, being steered and speeded by the same lever, being steered by a sidewise motion of the lever and speeded by a vertical motion. It is provided with a powerful brake, and as its motors are wholly independent, one will propel the carriage even if accident affects the other. As an electric spark explodes the charge, the danger of explosion is reduced to a minimum.



THE KANE-PENNINGTON VICTORIA.

Messrs. Thomas Kane & Company, of Chicago, entered four vehicles for the race. These are a four-wheeled victoria with a seating capacity for four persons, a four-wheeled victoria with seating capacity for two persons, a tandem motocycle and a single motocycle. The one shown in our engraving is the victoria for two persons. As will be seen by the engraving, the carriages differ radically from the ordinary type of carriage.

The makers have, in fact, gone back to the early days of Rome, when the low chariots were used by the nobility, as well as in warfare and in the races and public games. The victoria is such a type of vehicle and is constructed low so that one can get easily in and out and there is no liability of overturning. The wheels are so low that the best results are obtained from the motive power for speed and economy in running; 26 inch wheels are used, with heavy steel spokes and 4 inch pneumatic tires. These tires are manufactured by the well known bicycle tire manufacturers, Morgan & Wright, and are non-puncturable. They are also attached mechanically to the rim, so that it is impossible to pull them off, as is the case with a glued tire.

THE DURYEA MOTOR WAGON.

The frame of the victoria is very novel in its construction and combines the greatest strength from the least weight. It is constructed of steel tubing with graceful bends, giving it great strength and beauty of outline. The natural spring from the frame and pneumatic tires gives the engine the same effect as a pivoted compass, rendering no vibration or uneven jar to the vehicle. There is a very ingenious device attached to the rear wheels, so that in turning a corner one wheel travels faster than the other and overcomes the difficulty which has always been experienced in motocycle vehicles. The steering apparatus is very simple and effective, consisting of the wheels being so pivoted on ball bearings that they can be readily turned by the steering handles.

A very unique but effective brake is attached to the side of the vehicle. It consists of a pivoted rod held in place by a coil spring and operated by being thrown as a friction against the ground.

The engine used in these carriages is the Pennington electro-oil engine, consisting simply of a steel tube, a piston and connecting rod, an inlet valve admitting the oil, with an outlet valve allowing the exhaust to escape and a simple electric device for operating the engine. Only about one gallon of water per horse power is required to cool the cylinder. The victoria shown in our engraving has attached to it one two horse power two cylinder engine. It has a maximum speed of twenty miles an hour and can be regulated down as slow as is required. The entire vehicle with machinery weighs less than four hundred pounds. The consumption of the fuel it is claimed does not exceed a gallon of oil per horse power in a fourteen hours run.

Vessel Damaged by a Whale.

Details have reached Plymouth of a strange occurrence at sea in Australian waters. The brigantine Handa Isler arrived at Sydney Harbor on Sept. 1 from New Zealand, presenting the appearance of having been struck by a heavy sea, as she was much damaged amidships. The vessel had made a fair voyage from Mercury Bay, New Zealand, with a cargo of timber up to within ten days of Sydney. At midday on August 24 two large whales were sighted, each being about 60 ft. in length. At first they appeared to be heading across the ship's bows, but they suddenly slewed round and came on toward the ship at a tremendous speed. The first whale struck the ship amidships and, although the vessel is 260 tons register and was laden with nearly a million feet of timber, the concussion was so great that the vessel shook from stem to stern. The second whale, fortunately, did not ram the ship, but dived just before reaching the Handa Isler, and passed under the keel. The brigantine was badly damaged by the collision and the whale must have been terribly injured, as the sea around was speedily dyed with its blood, and the animal did not rise after striking the vessel. The well of the ship was at once sounded, and it was discovered that the water was making at the rate of a foot an hour, which in a vessel so deeply laden was a very serious matter, Sydney being 220 miles distant. Examination showed that there was large dent in the side where the whale's head had butted in the planking and framework. As the water gained on the pumps the deck cargo was jettisoned, but continued pumping enabled the crew to finally get the vessel clear. On the next day, the weather being very favorable, a pad composed of green hides, in which pillows had been sewn, was fastened over the dent in the timbers. The inrush of water was then checked, and the vessel was also enabled to weather the severe gales which followed, and to reach Sydney Harbor in safety.

The Punkah Puller.

There are over 120 patents for punkah pullers, and yet none have come into general use in India. The jerk seems to be the rock upon which most inventors get wrecked, and to obtain this some most extraordinary devices are resorted to. One of the simplest machines is Agabeg's puller. The inventor gets his jerk by the use of a fly wheel on the shaft of the prime mover, and regulates the machine to suit the punkah by a sliding weight in the horizontal lever, to which the rope is attached. For a given punkah, once the weight is fixed, it wants no more adjusting. It was worked by a small Robinson hot air engine of 4 inch cylinder, and heated by Vaguer stove. It took about fifteen minutes to get up power and then ran eight hours, or until the oil in the reservoir was exhausted. The machine worked a 7 foot punkah, 24 strokes a minute with a 4 foot stroke. One of the same inventor's machines was worked by electricity with the same excellent result. So long as the coolie is cheaper than the cost of working a machine puller, there is no chance of their ever coming into general use.

IN India every resident must, under penalty of fine, have his name written up at the entrance of his house.

The Weather and Disease.

Poets and writers in all ages have made reference to the effects which changes of the weather produce in the human organism, and the archives of folk-lore would furnish much evidence that these effects have not passed unnoticed by the proletariat. Unfortunately, however, the subject has been adulterated with a great deal of superstition, which has in a great measure tended to retard intelligent inquiry. That the various atmospheric changes should have some effect upon our bodies is easily understood, for we know that alteration in the surface temperature, a change in the blood pressure or in the air pressure of the lungs, may affect the nervous system, and all these changes may be brought about by some peculiarity of the natural phenomena which we call weather. In recent years the subject has attracted attention by those most cómpetent to deal with the matter, and lately a meteorological station has been attached to the laboratories of the public health department at Rome, where lectures are given to students on the application of meteorology to hygiene. At present our knowledge of the way in which the weather acts upon the body is very limited, and must remain so until a larger number of data are collected. An attempt to trace the relation between weather and disease has recently been made by a fellow of the Royal Meteorological Society by bringing together a number of statistics dealing with the phenomena of the weather and some well known diseases, chiefly zymotic, presenting them by a graphic method in a systematic manner. Little attempt has been made to draw conclusions from these statistics, and until they have been digested by many minds perhaps the writer was wise in his omission. There are few people who could not give instances of the influence which the weather has upon them, either mentally or physically, and there are many medical men (who in other directions have no opportunity for original research) who might do some useful work by recording the result of their observations on the subject, and thus add considerably to our knowledge of the role which is played by the weather in the causation or prevention of disease. On some constitutions the seasons have a marked influence. With many the spring, with its bright days and clear air, is felt to be the time of the year when they get the most enjoyment from life; while others, probably of a more sensitive temperament, experience the greatest sum of happiness and health when peaceful autumn wraps the min its serene atmosphere. On the other hand, winter or summer, as the case may be, produces in other temperaments the greatest consummation of healthy vitality. Certain changes in the weather, too, tend to increase or diminish the amount of energy that we put into our daily work, and it has been stated that in a large factory from ten to twenty per cent less work is done on dull days and days of threatening storm. The whole subject is one which, pursued in a proper scientific spirit, should be productive of useful results.—The Lancet, London.

Preparation of Table Sirups.

BY HORACE E. HORTON.

Glucose sirup of the gravity 41° to 42° Baume, mixed with "cane stock" molasses and variously flavored, comes on the market as table sirup.

This sirup has a variety of names: "Honey Dew," "Honey Drips," "Maple Sirup," the wholesale dealer furnishing the name, the factory branding.

The preparation of table sirups is carried on either by the factory producing glucose sirup or by "mixing houses." The glucose manufacturers confine themselves to mixing glucose with "cane stock" from sugar refineries, unflavored, or flavored with vanilla. The mixing houses manufacture table sirups, molasses, honeys, maple sirup.

In describing the process of preparing table sirup at a glucose factory, it will be necessary to briefly sketch the process of glucose manufacture up to the point at which the cane stock is added.

The starch in the form of 20° to 22° Baume liquor is inverted with acids, and the resulting liquor has a density of 15° Baume. This liquor is filter-pressed, and run over bone-black; then boiled in a vacuum pan to the density of 29° Baume, when it is again run over bone-black. The 29° Baume liquor from bone filters is taken into vacuum pan and boiled to 39° Baume, when the pan is "struck" into a tank provided with heating coil and mechanical stirrer.

The glucose is taken in hand at this point by the man in charge of the sirup department.

The stirrer is started and a strong solution of sodium chloride added to disguise the peculiar insipid taste of the glucose. At this point a part or all of the cane stock is added and the stirrer run until the two sirups are well mixed; the mixture is then filter-pressed, using presses clothed with a good quality of Canton flannel. The clear, bright, filtered sirup is taken into a vacuum pan and boiled to a finish. When part of the cane stock is added in the mixing tank the second and last addition is made to liquor in the finishing pan.

When boiled to desired density, 40° to 42° Baume, the pan is struck into a cooler, where it is cooled to 85°, and flavoring, if any, added. From the cooler the table sirup is drawn into basswood or cypress barrels, and branded for the wholesale merchant.

The proportion of glucose sirup to cane stock varies; 95 to 96 per cent glucose sirup, 5 to 6 per cent cane stock, is a mixture which has given satisfaction for the past few years. Previous to this the mixture 70 glucose sirup, 30 cane stock, was prepared, but public taste has increased the percentage of glucose sirup.

A fine grade of table sirup, with a marked flavor of vanilla, is given by the following mixture:

Forty-seven barrels 41° Baume glucose sirup; 3 barrels 40° to 41° Baume cane stock; 1 bucket 20° Baume sodium chloride solution; 1 gallon 2 pints vanilla extract.

For a flavor suggesting vanilla use three-quarters of a gallon vanilla extract.

The finest and smoothest tasting sirups are those made from glucose produced by the oxalic acid process. Glucose by oxalic acid, filtered over a peculiarly prepared bone-black, has no competitor. The taste is smooth and distinctly sweet, in marked contrast with muriatic acid and sulphuric acid glucose. It needs but a slight addition of cane stock and sodium chloride to make it an unrivaled pancake sirup.

The process of manufacture is scrupulously clean and protected from bacteria contamination by strict adherence to antiseptic rules. It is prepared from corn starch by a process which insures a minimum of nitrogenous products in the finished product.

An inferior article of mixing glucose is now offered on the market; an article manufactured with no other idea than cheapness, and of such poor quality that large quantities of sodium bisulphate are necessary to prevent discoloration during the short time intervening between production and consumption. Some table sirups prepared from this glucose have a distinct sulphurous taste.

Table sirups manufactured by mixing houses are prepared by mixing glucose sirup 41° and 42° Baume with varying quantities of open kettle molasses, plantation centrifugal molasses (mill and diffusion), honey or maple sirup.

Open kettle New Orleans molasses rarely, if ever, reaches Northern markets. To secure it in New Orleans is sometimes difficult. The grade known as "prime" sells at 60 to 63 cents on the levee. This is mixed with glucose in varying proportions to please the customer, and the result is pleasing when a large quantity of molasses is used.

Large quantities of plantation centrifugal molasses selling at 7 to 22 cents a gallon and graded, fancy; choice; strict prime, good prime, prime; good fair, fair; good common, common; inferior, give great latitude to the "mixer," and the results are wondrous.

Mixing houses producing sirups proceed as follows:

The glucose in barrels received from glucose manufacturers is placed in a warm room until it will run easily, when the barrels are emptied into an iron tank provided with a heating coil and stirrer. The mixing is done in this or a similar tank.

After adding the molasses, honey, maple sirup, with necessary flavoring extract, the stirrer is run until the mixture is homogeneous, when it is cooled and drawn into barrels. Care should be exercised in running the stirrer, that no air is drawn into the sirup, for great difficulty will be experienced in freeing the sirup from small air bubbles.

I will give a practical example of mixing house work, and at the same time call attention to the use of phosphoric acid in producing bright, clear goods.

A fair grade of molasses is produced by the following mixture:

Glucose	6 parts.
Cane stock	1 "
Black strap	½ "

A homogeneous sirup is prepared from these sirups by using a steam coil and stirrer judiciously; the resulting molasses will, however, have a dull appearance. To brighten this molasses I know of no better way than to use phosphoric acid in the form of a superphosphate. The addition of ½ per cent superphosphate, alone or with milk of lime, and filtering, will give brilliancy to molasses.

The Rumford Chemical Works, of Providence, R. I., have an especially fine superphosphate; L. C. Keever & Company, of New Orleans, have an article known as "Clariphos."

The superphosphate may be prepared by digesting 100 pounds bone dust with 70 pounds sulphuric acid, 60° Baume, for 24 hours; water is then added, well stirred, filtered, and the filtrate evaporated to 16½° Baume, or heavier. The value of the resulting superphosphate solution, in units Ca O, is determined by titrating with calcium hydrate solution.

The proportions and grades of molasses mixed with glucose will be governed by the market price and the idiosyncrasy of the market. A large population in the New England States call for a Porto Rico molasses, the characteristics of which are a "black strap" flavor, with a seeming acidity. Another class of trade have a taste calling for a product represented by the Louisiana product, "sirop de batterie," a product of unrivaled delicacy, enjoyed by the favored few in Louisiana. Western trade demands a product of great viscosity, easily produced by mixing a low converted glucose of high dextrine content.—Louisiana Planter.

The Process of Gold Beating.

The following facts relating to the art of gold beating are taken from the Argosy:

"The gold to be used is alloyed with silver or copper, according to the color desired, and cast in ingots four inches in length, and weighing from ten to seventeen ounces. The second process consists in passing the four inch ingot between polished steam rollers. This reduces the gold to a ribbon twenty-eight yards in length, and $\frac{1}{800}$ part of an inch in thickness. Seven yards of this ribbon are cut into 180 pieces one inch square. These are placed singly between the leaves of a bundle of vellum, technically known as a 'cutch.'

"They are then inclosed in a parchment case and beaten for half an hour with a twenty pound hammer. By this time the gold is extended into squares of three inches. These are removed from the cutch and quartered.

"The next tool used is called a 'showder.' It consists of 720 'gold beaters' skins' four inches square. The gold beaters' skins are bought in packets of 900 leaves, and for each packet the intestines of 500 oxen are required. They are manufactured from the outer membrane of the large intestine by an exceedingly offensive process, as the intestine requires to be subjected to partial putrefaction before it can be separated from the membrane.

"Although the skins have a delicate appearance and are beaten for several hours every day with a ten pound hammer, they generally last about a year, when they are renewed for thirty-five or forty dollars. The 720 pieces of gold are beaten in the showder for an hour and a quarter, till they increase from one and a half to four inches square.

"Another quartering then takes place, and the pieces are then placed between the skins in a tool called a 'mould,' and beaten for a third time. This mould is filled three times, thus producing 2,880 leaves from the 80 pieces. It has been beaten altogether about five hours. The cutch, the showder and the mould, before being filled with gold, are subjected to treatment in hot presses, formed on the principle of a letter press, for the purpose of clearing the tools from damp.

"With an instrument called a 'wagon' the gold is cut to its final size (a square of three and three-eighths inches) and is then lifted into books of tissue paper, the leaves of which have been previously rubbed with red chalk to prevent adhesion. The leaf is now only $\frac{1}{280000}$ of an inch in thickness, and when held up to the light appears to be green. It is calculated that one ounce of gold may be converted into leaf sufficient to gild silver wire about 1,300 miles in length."

The Chicago Drainage Canal.

The report of the board of engineers detailed by the Secretary of War to report upon the probable effect and operation of the Chicago drainage canal upon the lake and harbor levels, and upon the navigation of the great lakes and their connecting waterways, has been made public. There is nothing to show, the report says, that the consent of Congress has been asked for this enterprise, and it is certain that it has not been treated as an interstate or international affair. With this established fact it is impossible to think that supervision of the United States will not extend to the canal in due time. This will become necessary as soon as it becomes a part of the system of navigable waterways. If the new outlet reduces the levels of Lakes Michigan and Huron about 6 inches, that effect will be produced in about two years, it not being a question of many years, as some suppose. The board feels very sure therefore, that: First, the drainage canal is not solely a State affair, but a national one. Second, the tapping of the lakes must affect their levels. If the level of the lakes should be reduced, vessels would have to load accordingly. The trustees of the drainage company now contemplate the abstraction of only 300,000 cubic feet, but after the canal is opened it is assumed that 600,000 cubic feet per minute will be drawn from Lake Michigan. This would lower the level of all the lakes of the system except Lake Superior, and reduce the navigable capacities of all harbors and shallows throughout the system. Under the laws of the United States these changes in capacity cannot be made without federal authority, and to enable the executive officers of the United States to act advisedly in the matter, it is necessary, in the opinion of the board, not only that measurements be taken, but that the money cost of restoring the navigable depths in channels and harbors be carefully estimated. The navigable capacity of all harbors and channels on the great lakes below St. Mary's Falls would be injuriously affected by the proposed canal, and the navigability of the inner harbor of Chicago would be made difficult by the introduction of a current therein.

Correspondence.

History of the Thread Spool Industry.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of September 28 is a mention of the thread spool industry of Maine, in which appears the statement that it began twenty-five years ago.

It can be of no interest to the public, but the writer of that article might like to know that forty-five years is nearer the date.

In 1853 or 1854 two men, Harnden and Leland, went to Augusta, Me., and commenced the manufacture of thread spools. They were from Massachusetts. My father furnished them the timber, cut, sawed, and seasoned at Fayette in that State. After being burned out in Augusta the whole business was removed to Fayette and carried on there by Mr. Leland.

My father furnished the capital for the business and I worked in the woods getting out timber, and in the mill making spools during those years.

Mr. Leland sold out and left the State. His successor removed the plant to another part of the State, where timber was more plenty. The business has been prosecuted in that State ever since. EDWARD CRAIG.

New York, October, 1895.

The New Carborundum Works at Niagara Falls.

Among the new industries resulting from the economical production of the electrical current is that of carborundum, or artificial diamonds, used in the arts as an abrasive, and ranking next to the diamond in hardness. The following account of the opening of the new works is from the Electrical Engineer:

The formal opening of the new works of the Carborundum Company, at Niagara Falls, took place October 19, in the presence of a number of invited guests, and thus was inaugurated a plant which will unquestionably rank among the most important that have thus far been attracted to the Falls.

Before entering upon a description of the work accomplished with the new equipment it may be of interest to relate the events which have led to the creation of the new carborundum works. It will be recalled that, prior to the starting of its Niagara Falls plant, the Carborundum Company manufactured carborundum at Monongahela, Pa., using steam power to produce the current, the daily output amounting to about three hundred pounds. Although the making of carborundum is now carried on only at Niagara Falls, the old plant is operated in making finished goods from the grain and powder carborundum sent from the new plant.

Owing to the limited facilities heretofore existing, the production of carborundum had been so small as to practically restrict its uses to the finer trades, such as the dental and manufacturing jewelers', fine tool grinding, pearl grinding, and kindred industries. The development in the dental trade especially has been remarkable, and, in the form of disks, lathe and engine wheels and cloth finishing, carborundum is rapidly displacing all other abrasives in this important trade, not only in the United States but throughout Europe.

This development is also noticeable in the jewelry trades, where, in the form of wheels and powders, it is used in polishing and grinding the delicate wheels, springs, etc., in the manufacture of watches. Its value is materially enhanced because of the fact that owing to its exceeding hardness, the finest, impalpable powders have remarkable cutting properties; and although no special effort has been made to introduce it into the glass grinding and finishing industries, its value as a superior abrasive for these purposes is recognized.

Its utility has been demonstrated in the more important grinding trades, such as car wheel grinding, machine shop finishing, and all other industries using large wheels; its rapid cutting qualities resulting in a saving of labor and time, a valuable consideration in any manufacturing interest. This large field has remained practically closed, owing to the inability of the Carborundum Company to make a sufficient quantity of the material to manufacture wheels larger than twelve inches in diameter for the general trade, large orders being constantly turned away.

To produce carborundum at the lowest possible cost, and thereby permit of its general adoption as an abrasive for all classes of work, has of course been a subject of vast importance to the Carborundum Company, and after having investigated the possibilities of Niagara Falls as a manufacturing point, they determined to locate a plant in that city that they might have the benefits of cheap power from the Power Company and have also the advantage of railway facilities there offered. A contract was made with the Niagara Falls Power Company for 10,000 horse power to be delivered as required for the purposes of their manufacture, and it is thought that the initial 1,000 horse power now being used will be added to at an early day, and with that in view the plant has been constructed to accommodate 3,000 to 4,000 horse power.

With this brief history, let us now follow the crude materials through the various processes to the state of finished product.

The various buildings and apartments of this superb plant are admirably arranged for the economical handling and manipulation of the materials. The stock building, into which are received the crude materials, is provided with a railway track connecting with the Niagara Junction Railroad, on which the loaded cars are conveyed to the various bins or compartments provided for the reception of the crude materials, which consist of coke from the Pennsylvania bituminous coal fields, white sand from Ohio, salt from the salt works of New York State and sawdust from the mills of Tonawanda. Conveniently arranged, in relation to the storage bins of crude materials, is a most complete grinding, grading, and mixing plant, into which the coke as it comes from the cars is introduced and ground and sifted into assorted sized grains and conveyed into bins, from which it is drawn and mixed in proper proportion, with measured quantities of sand, salt, and sawdust, and these measured quantities thoroughly mixed and delivered in a bin provided for the finished mixture. This work is done by automatic machinery at the least expenditure of manual labor.

The four crude materials having been wrought into what is called the mixture, they are conveyed to the electrical furnaces in an adjoining building. It would, perhaps, be difficult for one unskilled in the arts of the electro-metallurgist and unfamiliar with the apparatus he employs in producing his transformations, to recognize the rough and apparently crude oblong brick boxes, made without cement, mortar, or other binding materials, as furnaces. Provision is made for five of these furnaces, extending down one side of the large spacious building, each of them measuring about fifteen feet in length by seven feet in width and the same in height. In the center of each end is placed a large bronze plate and these are connected by means of four large copper cables to massive copper bars extending under the floor at either end of the furnaces. Connecting with the inner surfaces of the bronze plates are one hundred and twenty carbon rods, sixty to each plate. These carbon rods are three inches in diameter and a little over two feet in length, and they are so placed as to pass through the end walls of the brick furnace, projecting into the interior and toward each other, thus constituting the terminals. Into this furnace the mixture that has been prepared in the stock rooms is introduced, about ten tons constituting a charge; and through the center of the mass of mixed materials is placed a core or cylinder of granules of crushed coke extending from the carbon rods at one end of the furnace to those at the other end, and making a perfect electrical connection through the furnace by means of the bronze plates, carbon rods and the core.

The furnace, as above described, is prepared for the turning on of the current, and this is provided for and controlled in the adjoining building which was specially constructed for the transforming apparatus used in reducing the high pressure current as received from the dynamos of the Niagara Falls Power Company, to the low pressure current used in the electric furnaces. Located in the same building is the regulating apparatus used in controlling the current as it passes to the furnaces.

When everything has been properly prepared, the connections to the furnace are completed, and 1,000 horse power of electric current is turned into the granular core, above referred to, and kept on for twenty-four consecutive hours, making a total expenditure of energy of 24,000 horse power hours. All of this vast amount of energy is transmitted to the core—twenty-one inches in diameter and about nine feet long.

About two hours after the turning on of the current gases begin to escape through the crevices of the brick walls of the furnace, and being ignited they burn with a lambent blue flame. As the process continues, the outer walls and top of the mass in the furnace show a slow rise in temperature, the effect of the transmission of the intense heat from the core, the entire top of the mass becoming redhot in about twelve hours. After the current has remained on for the period of twenty-four hours, or until such time as the workman in charge recognizes that the process is complete, the current is stopped in the transformer building, the flexible cables are disconnected from the bronze plates and others are connected with the plates of the next furnace in the series of five, and it in turn is carried through the same operation.

Interesting as the work may have been up to the point of stopping the current, it cannot compare with that at the moment of opening a furnace. One end of the furnace is removed and a cross section through its center exposed, thus permitting of a ready inspection of the result of the operation. In the center is the granular core, in the same position in which it was originally placed, but it is now purified of all foreign substances. It is now pure carbon and has lost about one-fourth of its weight, this loss representing the volatilized impurities. The presence of grains of graphite disseminated throughout its mass indicates that its temperature must have been near 7,000 degrees, which is the point of graphite formation. Surrounding the core, in the form of a cylinder, is a beautiful crystalline formation, the crystals being constructed on lines radiating from the center. Those crystals in immediate contact with the core are looped or built together into one concrete mass, this solid formation giving way to a loose structure as the distance from the core is increased; the size of the crystals, at the same time, diminishes rapidly, until at about fifteen inches all crystallization ceases and is followed by an amorphous material, of a whitish gray color for a distance of about two inches, when a sudden change occurs to a black mass composed of the original mixture, now held together in a cemented state by the fusion of the salt.

The crystalline and amorphous material lying between the core and the outer black mass is carbide of silicon, being composed of carbon and silicon, atom for atom. It is this material that was discovered by Mr. Acheson and by him called carborundum. About two tons of carborundum is produced in one furnace run, and to prepare it for the market it is first passed under heavy iron rolls, for the purpose of crushing apart and separating the individual crystals, after which it is treated with an acid and water bath to remove all solubles. It is then dried and sifted, to separate the various sized grains, and placed in bins ready for packing for shipment, or to be worked up into wheels, hones, or other forms in which abrasives are used.

At the opening the guests were welcomed by Mr. E. G. Acheson, the president of the Carborundum Company and inventor of its process of manufacture; and to whose energy and ability the present excellent position of the company is principally due.

European Beet Sugar Industry.

The crop of beet sugar in Europe in the season of 1877-78 was 1,420,827 tons. The crop of the season of 1894-95 reaches 4,800,000 tons, an increase in seventeen years of about 350 per cent. This enormous increase in the production of sugar in Europe necessarily arises from the fact that the industry is more profitable to those engaged in it agriculturally and in sugar manufacture than are other industries. The knowledge that they could produce their own sugar supply with reasonable success has led to a full appreciation of the fact that sugar production in the temperate zone has been the one great possibility in agriculture that has not been completely developed. The actual monopoly of the sugar industry held by the tropics for centuries led to the assumption of the impossibility of successful competition with the tropics. The gradual awakening of the beet growers and sugar manufacturers in Europe to the grand opportunity that the sugar industry offered them as a new and profitable crop has finally so affected every leading continental nation in Europe that we find all of them legislating carefully to foster their sugar industry, with the results of enormous production in excess of the home consumption, until now, with their great crops, they are competing with each other actively for the good will of the only two large buyers left to them—Great Britain and the United States.

European statesmen are beginning to recognize the faults of the bounty system as practiced by them, it having so enormously developed their sugar industry.

In discussing the sugar question in Europe at the beginning of this year, one of the largest continental houses issued a circular wherein the following estimates of bounties paid by the respective governments in Europe on sugar there produced were given:

Germany	$5,781,250
France	10,000,000
Austria	2,000,000
Belgium	5,000,000
Total	$22,781,250

The bounties paid by Russia, Sweden and Denmark are omitted.

The consumption of sugar per capita is given as follows:

	Lb.
Great Britain	79
United States	77
France	30
Austria	29
Germany	28
Belgium	22

We thus see France, Austria and Germany consuming an extremely small amount of sugar per capita, and enormously increasing their home production by bounties, until they are deranging the entire sugar trade of the world. The following table shows how largely the production of beet sugar has increased during the last four years, while the cane sugar industry has stood comparatively still:

	1891-2.	1892-3.	1893-4.	1894-5.
Germany	1,198,000	1,225,000	1,303,000	1,900,000
Austria	786,000	803,000	842,000	1,100,000
France	650,000	588,000	579,000	830,000
Russia	551,000	455,000	666,000	630,000
Belgium	180,000	197,000	235,000	285,000
Holland, etc.	136,000	160,000	186,000	230,000
	3,501,000	3,428,000	3,805,000	4,975,000
Production of cane sugar	2,784,000	2,760,000	3,046,000	2,904,000
Total	6,285,000	6,188,000	6,941,000	7,879,000

—Louisiana Planter.

TRIAL OF UNITED STATES BATTLE SHIP IOWA'S BELT ARMOR.

Within the past few weeks practical tests were made at the naval proving grounds at Indian Head, Md., to determine the efficiency of the belt armor and structural support protecting the water line region of the battle ship Iowa, now building. Primarily the tests were to determine the acceptability of a group of armor plates of which the test plate was representative—the requirements being that the sample plate should withstand the attack of two 10 inch armor-piercing projectiles, the first without cracking and the second without perforation; the striking or perforative energy being, in the first shot, equal to the penetration of 12 inches of simple steel and in the second shot equal to the perforation of 16 inches of simple steel and a 36 inch oak backing. In these two particulars the plate was thoroughly satisfactory.

The plate was 16 feet long by 7½ feet high, backed above the bevel, as shown in Fig. 1, by 5 inches of oak, and rested upon a structural counterpart of the Iowa's inboard water line region, slightly lighter than will be the finished craft and correspondingly weaker. The armor fastenings were of the most recent design, and such, most likely, as will be used on our new battle ships.

The target was subjected to four attacks, the effect of which is shown in Fig. 2. Two of the attacks were by the 10 inch gun, one by the 12 inch gun and one by the 13 inch gun, at the respective distances of 388, 383 and 378 feet.

The head of the first shot effected a penetration of 3¾ inches, the point being welded in, while the remainder was shattered into many fragments and cast to a considerable distance. Otherwise the plate was intact. Again the 10 inch gun and a similar shell of 500 pounds was fired, this time with a charge of 217·2 pounds of powder, a striking velocity of 1,856 feet a second, and a striking energy of 11,954 foot tons, and succeeded in effecting a penetration of eleven inches. No cracks were developed in the armor, and save in rear of impact, where somewhat squeezed, the wood backing was substantially sound. Again the point was welded in the plate, the plate was slightly "dished," causing the ends to move away ⅜ inch from the backing, and one armor bolt was driven to the rear and several armor bolt fittings loosened.

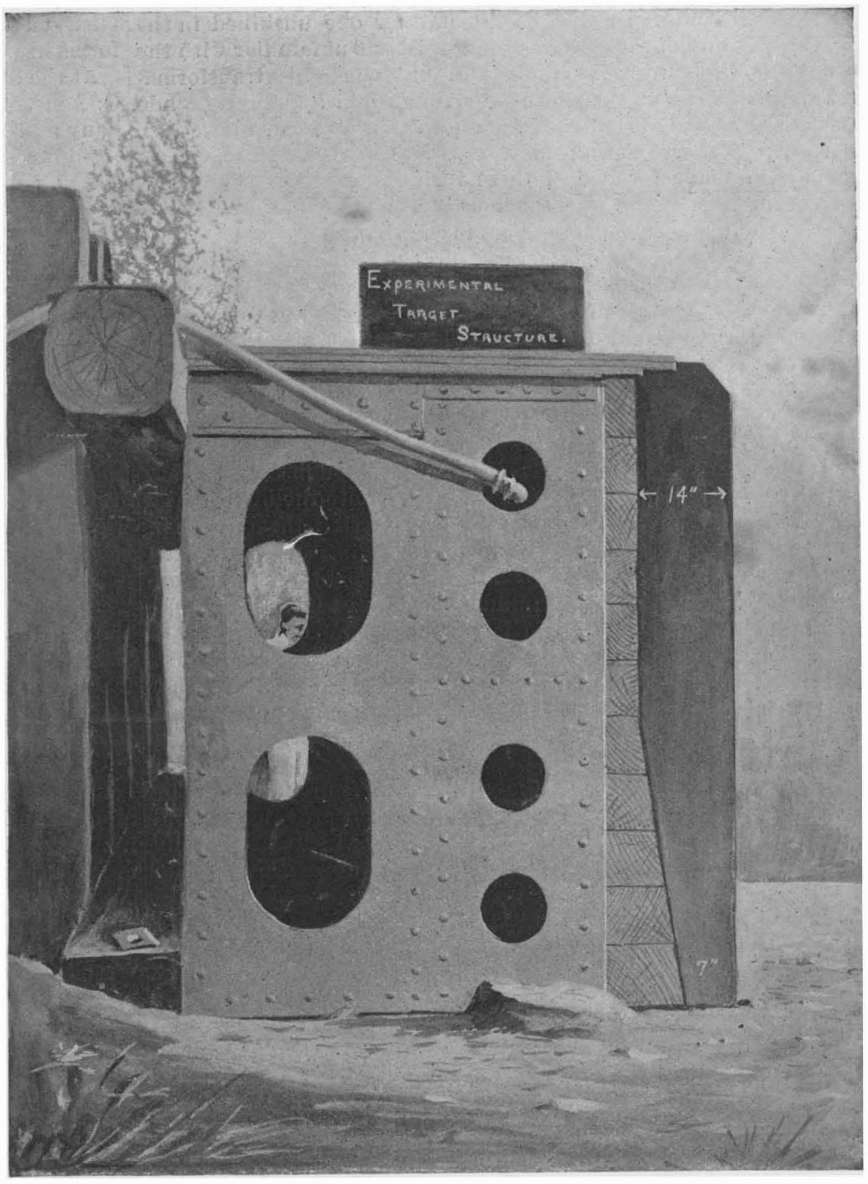
The third attack was made by the 12 inch gun, with a powder charge of 400·8 pounds, giving the 850 pound armor-piercing projectile a striking velocity of 1,800 feet a second and a striking energy of 19,114 foot tons—a force equal to the perforation of 19·39 inches of simple steel. The shot was destroyed with the exception of the part that effected the penetration of 17 inches. The plate was cracked through to the top and the bottom, and dished about an inch more. The neighboring wood backing was compressed to a thickness of one inch. Another armor bolt was driven to the rear; the backing plate at rear was bulged by bending of horizontal stiffeners within; but the target structure as a mass remained unmoved. The first attack had loosened eighteen bolts sufficiently to induce leaking, the distribution being about even between those with lead and those with leather washers.

The fourth attack was made by the 13 inch gun upon the remaining right hand fragment—a mass of about thirty tons. With a powder charge of 484·2 pounds, the 1,100 pound armor-piercing shell, with a striking velocity of 1,800 feet a second, a striking energy of 24,736 foot tons—a force equal to raising the whole ship as a mass over two feet—and a penetrative force equal to the perforation of 21·46 inches of plain steel, succeeded in passing through the entire target, two oak timbers of 16 inches thickness, and buried itself 12 feet in the sand butt to the rear, carrying the target as a mass back two inches. The armor was cracked through and through in three directions, shaking out part of projectile shown in Fig. 3, but the plate was unmoved. The structural plating and angles in pathway were torn and twisted into all kinds of shapes, denoting the superior character of the material, while the main part of target structure withstood the shock perfectly.

The projectile was warm when recovered two hours after impact, the point, as indicated in Fig. 3, was fused away and gone, the head marked with fine cracks partly through, while the whole shell was shortened three inches by compression and increased one-half an inch in diameter about the bourrelet. Pieces of the plate, weighing 500 and 600 pounds, were detached and driven into the structural part of the target.

The velocities were calculated to represent the full power effect of the 12 inch rifle at 2,300 yards and the like force of the 13 inch gun at 2,500 yards, the powder charges being reduced to that end.

Primarily the result shows the superior destructive power of the 12 inch rifle; but also shows the toughness and resistibility of Harveyized nickel steel, as was the armor plate, the structural efficiency of the supporting framework, and the vast amount of punishment that can be borne without irreparable injury; and further emphasizes the improbability of placing, at fighting range, so many large shots within so small an area, and with a normal impact. To the layman, the consequences are even more interesting when he knows that that heavy plate was backed up and held against those tremendous blows by a combination of plating and angles, the thickest of which was a double layer of half inch plates, while the others were a scant quarter.



[Represents framing behind the belt armor of the Iowa, with ballistic test plate B-230, group No. 21, Iowa's 14 inch Harveyized nickel-steel side armor plate mounted thereon.]

FIG. 1.—BATTLE SHIP IOWA—EXPERIMENTAL TARGET STRUCTURE FOR TESTING BELT ARMOR.

A Mountain Railroad in India.

A mountain railroad of great strategic value has just been completed by the British government in the Indian frontier. It runs through the famous Bolan Pass—in which so many English soldiers have perished—to the important post of Quetta. Ten years ago a railroad was opened from Sibi to Quetta, but this has proved a complete failure in consequence of frequent landslides. The new road runs over the old one at the start and the finish, but the sixty miles in the middle, which traverse the pass, constitute a short cut, and have been constructed in the face of extraordinary engineering difficulties. The highest point of the line is at Kolpur, 5,463 feet above Sibi, and 17 tunnels, varying from 100 to 1,000 yards, have been cut through rock or clay where the foundation seemed surest. Of these tunnels, that through the Panir Hill was the most difficult and important. It is 1,000 yards in length. If the tunnels on this line are important, the bridges are not less so, the main object to be achieved being the defeat of the Bolan River, which, when flooded, becomes a torrent, sweeping all embankments and bridges before it. There are many bridges of only a few yards in length, but the two most important are those called the Hanar and the Ocepur. These are each more than 150 yards in length, and they are 65 feet above the river when in torrent and are practically secure against the worst floods. To give an idea of the difficulty of the route, it may be mentioned that in the most difficult section of all—between Hirok and Kolpur—the Bolan ravine is crossed nine times in four miles.

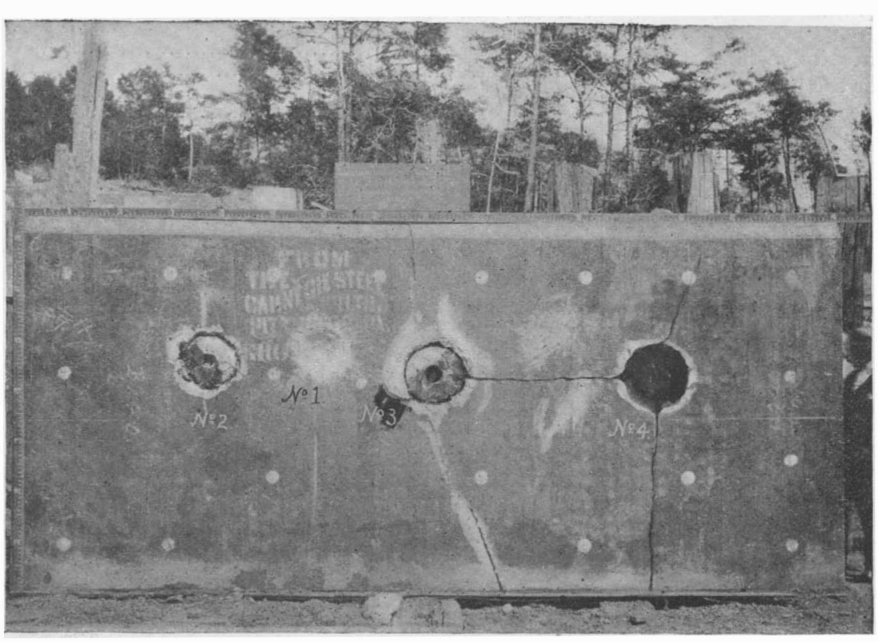


Fig. 2.—BATTLE SHIP IOWA ARMOR TESTED BY 10, 12, AND 13 INCH GUNS.

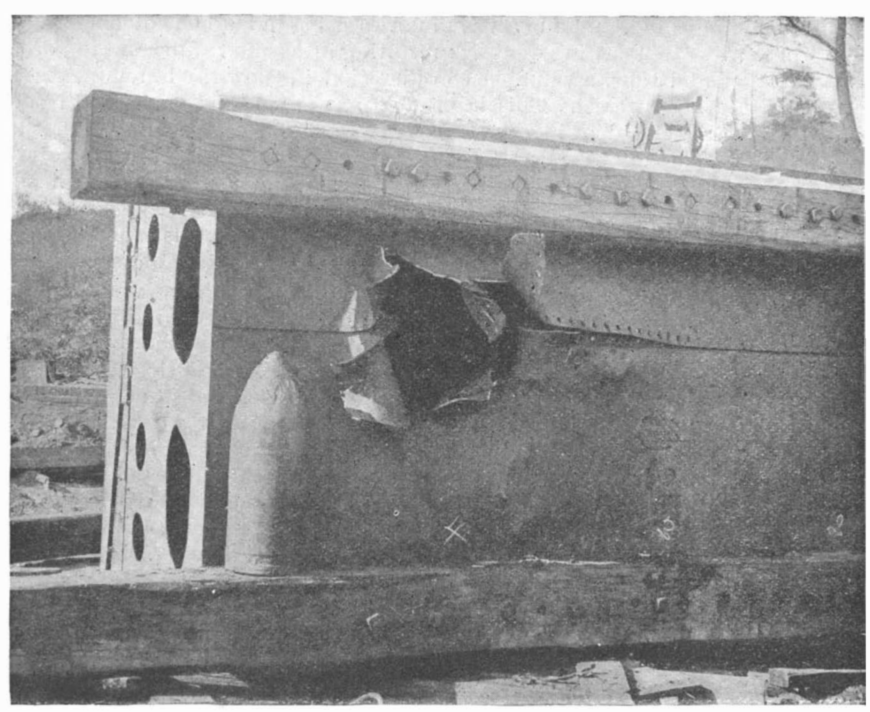
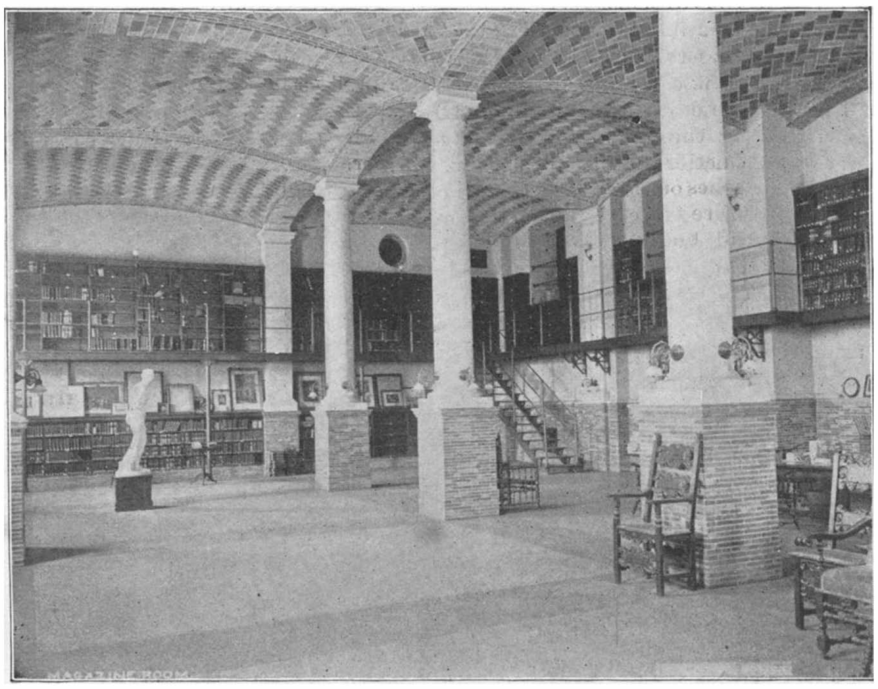


Fig. 3.—BATTLE SHIP IOWA ARMOR PIERCED BY 13 INCH GUN.

THE BOSTON PUBLIC LIBRARY.

To the stranger sojourning a few days in Boston a strong consciousness of the civic and urban pride of the inhabitants early presents itself. A quiet pride in their city seems to be a characteristic of all the inhabitants. No institution of the city has been a juster object of such pride than the famous Boston Library, which for many years dispensed its literary hospitality from the old building on Boylston Street, as well as from numerous branch libraries in Charlestown and elsewhere. On December 1, 1894, there were 608,466 volumes in the Library. In 1892, 25,000 new books were added, so that, at this rate of increase, but sixteen years will elapse before the round million is reached. It is told of the public library in Berlin that it was moved from one building to another in a day, an entire regiment of soldiers being detailed for the task. When the Boston Library trustees determined to erect a new building, and after such building was completed, five weeks to a day were occupied in the transfer of the contents, and during that period there was hardly a break in the work of all the departments. We illustrate the new building in the present issue with reference to its structural and technical features, as well as from the art aspect. It fronts on Copley Square, directly opposite Old Trinity. Its architects were the New York firm of McKim, Meade & White, identified with so many of the most beautiful buildings of this country; in this city notably the Madison Square Garden and the Washington Arch.

The building, in the Renaissance style, is, to a certain extent, based upon the Bibliotheque St. Geneviève, Paris. In the string course under the lower windows, in the more massive columns of the upper arcades, and in the somewhat severer character of its architecture, variations on the prototype are found which distinguish one from the other. The use of a typical horizontal style of architecture in Copley Square was dictated by several considerations. Any approach to the perpendicular style would have seemed to involve competition with existing structures, and the great area devoted to books demanded a serious treatment. The front is of Milford granite, grayish white in color with pink spots. The tablets which close a portion of the arches of the arcade are inscribed with the names of great artists, writers and scientists, comprising a very long roll of honor, four names being accidentally duplicated. In the spandrels between the arches are thirty-three medallions carved in granite, mostly copies of the trade marks of early printers. Various inscriptions are placed over the entrances.



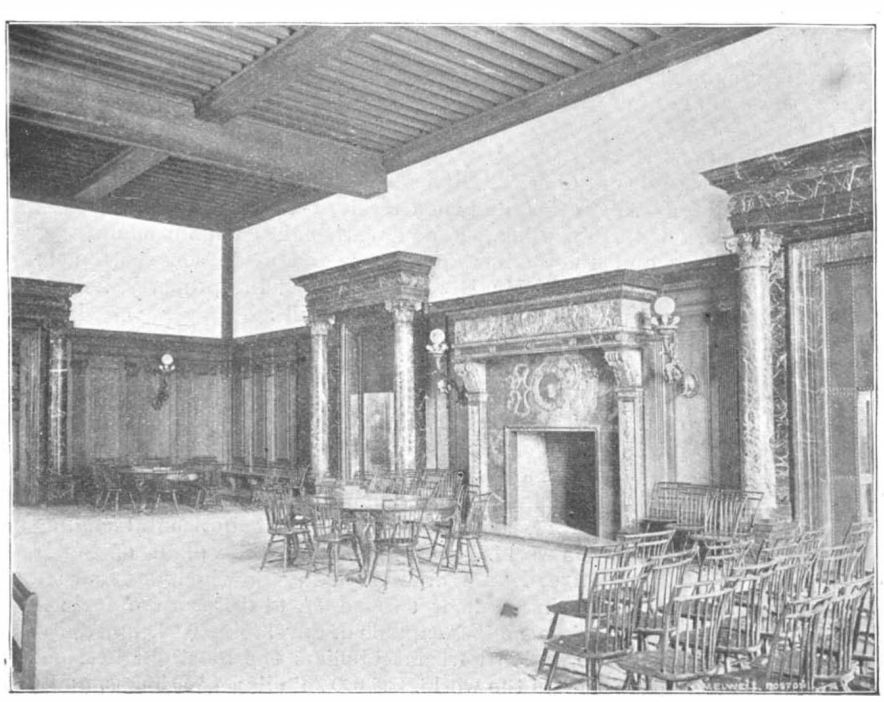
THE PERIODICAL ROOM.

The building is 225 feet long, 227 feet deep, and its cornice is 70 feet above the sidewalk. The great central reading room runs across the entire front of the building and is 218 feet long and 42½ feet wide and 50 feet high. This is furnished with tables and chairs for readers, who also have free access to a special collection of books in open cases in the hall, from whence they may be taken without appeal to any attendant. At the end of the room is the great card catalogue, a really monumental example of library work, contained in the most approved cases, while numerous tables and seats of special design are placed within the semicircle of card cases, in order that the readers may consult the index in comfort. In this main reading room, termed Bates Hall, those who desire books from the main collection enter the name and designation of the book desired on a slip on which they also write the number of their table. The slip is handed to the attendant, and in a few minutes the book is brought to the reader at his table. Immediately back of Bates Hall is a great quadrangle or open court, surrounded by a very beautiful arcade of columns, with a fountain in the center, which court it is proposed to have opened to the public, to whom it will afford a delightful retreat and may serve as a species of outdoor reading place.

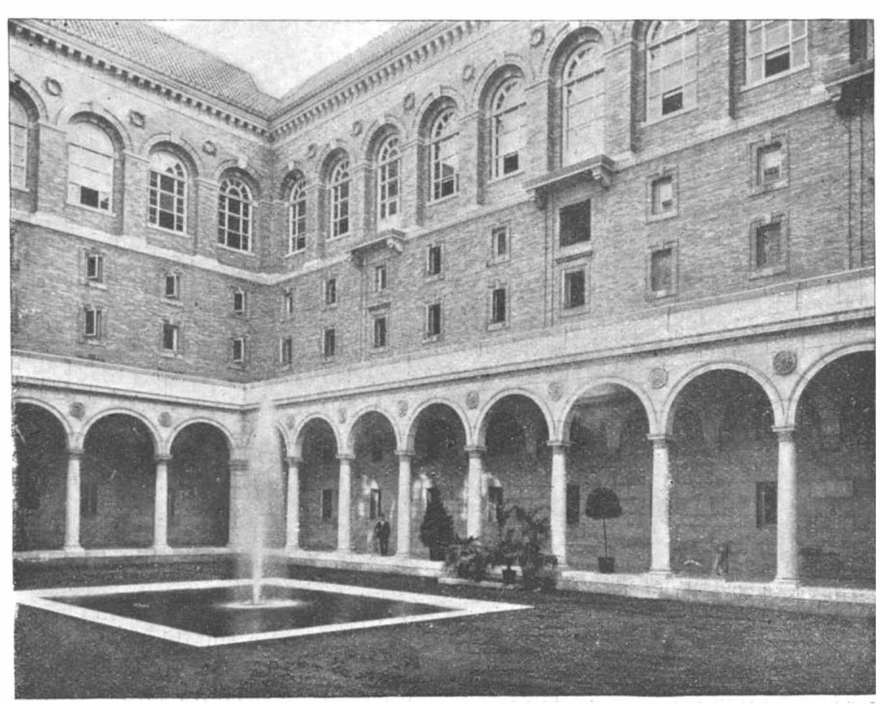
The interior court, with its graceful loggia surrounding it, and its central square basin and fountain, forms a cloister in the heart of the library. The walls of the buildings are of yellow brick and Medford granite. The arcaded colonnade or loggia runs around three sides of the court, the wall of the grand staircase projecting from the fourth side.

The portion of the building which lies between this courtyard and Copley Square is devoted to the administrative officers of the library, to Bates Hall, and to certain special collections of books and relics. The stack rooms with their book stacks occupy the buildings on the other sides of the central court, and it is here that the most impressive part of the library is found. Instead of high stories with tall book stacks rising from floor to ceiling, we find the great building divided into six stories by low ceilings and occupied by interminable lengths of simple pine book shelves on which the books are stacked. Leaving the Bates Hall with its high arched roof, leaving behind the magnificent marble and brass work and structures of the main entrance and passing into the stack rooms, the contrast is startling, it seeming almost like a visit to the catacombs. The book shelves are painted white, the ceilings are white, pendent incandescent lights are extended by long flexible cords to the place where required, and here and there at intervals are seen the attendants waiting to distribute the books. The vast.

SCENE IN STACK ROOMS, SHOWING BOOK DELIVERY RAILWAY AND VIEW OF THE INNER COURT.



THE DELIVERY ROOM.



THE CENTRAL COURT, COLONNADE, AND FOUNTAIN.

THE BOSTON PUBLIC LIBRARY.

ness of this department may be realized from the fact that the books now on the shelves occupy from 80,000 to 100,000 feet of shelf room, which is from 12 to 15 miles, and a quantity of shelf room is still unoccupied. For, without disturbing its present plan, about 2,000,000 volumes, or three times the present number, can be accommodated. Simply to walk the length represented by the occupied shelves would take a good pedestrian four hours.

It is evident that the problem of the distribution of the books to the reader was a difficult one, and it was solved by the use of pneumatic tubes and a very perfect cable railroad driven by electricity. The six floors of the stack building are traversed by a cable road on the order of the familiar cash railroad used in large stores, and pneumatic tubes are carried to all parts of the building. When a book is called for, the slip is placed in a cylindrical box and is sent through the tube to the stack room. Here it is received by the proper attendant, who, taking the book from the shelves, places it in a little car, and starts the car on its journey. Constantly moving cables are caught by the car grip, and quickly draw the car from the stack rooms directly to the distributing desk, if on the same floor, and if not to elevators, which automatically transfer it to the delivery room floor, where the book is received by attendants at the desk and handed to the applicant. Books are returned to the stack room by the same method.

The system is illustrated in detail in the illustrations, among which a sectional view of a portion of the building is given, to show the whole plant at a glance. Each of the six stack floors is traversed by a cable road of eight inch gage. The cables are kept in motion by an electric motor in the basement of the building. The delivery room, where all the books are sent and whence they are redistributed, is approximately on the level of the fourth stack floor. From this floor the cable road runs directly to the delivery room. For the other floors elevators are provided, working in a shaft which is shown in the sectional view already alluded to. The book cars are automatically transferred from railway to elevator, and are raised or lowered as required for sending to their proper destination.

The cable works in a vertical plane, the upper element running from the delivery room to the stacks, and the lower element in the reverse direction. Two tracks, one vertically over the other, run throughout the stack rooms, and the end view of the brackets carrying them is shown in the cut. When a car is sent from the delivery room to the stacks it traverses the upper track, and near the end of its course has its grip automatically tripped. Running on by inertia, it has its course gradually checked, and stops upon the transfer table shown in Fig. 1 of the small cut of the transfer table and pneumatic tube connection. The table descends automatically to the level of the lower track, and stops there, and the car stays upon a switch on the lower level. When books are to be sent to the delivery desk, they are put into the car, the attendant pushes it off, and as it leaves the switch and reaches the main track, the grip seizes the cable and the car starts off on its long voyage, stopping finally in the delivery room. To check it as it enters the elevators, and to check the too rapid descent of the transfer table, buffers, counterweights, and retarding apparatus are provided. In the cut of the transfer table, the pneumatic buffer and the counterweight are seen beneath the table.

Fig. 2 of the same cut shows the pneumatic tube terminal connections. Orders for books are sent by these tubes to the stack rooms. A receptacle for the boxes is placed directly beneath the opening of the tubes. As the box, after traversing the tube, is expelled from its end, it is projected into this receptacle, strikes a strap, and rings a bell, notifying the attendant of its arrival. The connections are shown in section. The large illustration shows the lines of tube traversing the building, all centering in the delivery room; the ends can be seen behind the delivery desk.

The delivery room is the link connecting the public portions of the library with the secluded stack rooms, and is the most sumptuous room in the building. Here the public apply for books, and one of our illustrations shows the main room, while the portion behind the delivery desk, where the lines of railway, elevators, and pneumatic tubes have their terminus, is shown in another view. The room has a wainscot about 11 feet high, of light colored oak, the ceiling is painted in dark blue and purple; the doorways and mantel piece are in highly colored marble, and the floor is covered with tiles of Istrian and Verona marble. The room is 64 feet long and 33 feet wide. The paintings of the Quest of the Holy Grail, by Edwin A. Abbey, decorate the space above the wainscot.

The periodical room is characterized by its low arched construction of ceiling, carried by a number of columns. More than 200 newspapers are received and at the disposal of the public. The room was originally intended as a lecture hall, but the offer of Mr. William C. Todd, of New Hampshire, to give $2,000 per annum and to endow it in his will to that extent for the purchase of newspapers caused the abandonment of the lecture room project.

We have spoken already of the great card catalogue. The problem of managing it has become so vast that it is now proposed to print the titles for the cards, using machines of the linotype class, so as to obtain the titles in solid slugs or lines. These slugs will then be utilized for printing the card catalogue and will be preserved so as to be applicable for printing special book catalogues if desired. The production of a complete book catalogue is practically impossible. It was estimated a few years ago, when the collection was smaller than it now is, that, with the maximum of compression, involving the use of small type and a quarto size of volume, 17 volumes of 650 pages each would be required for the catalogue. All work in the shape of catalogues other than the card catalogue will probably take the shape of special publications in special lines of work. The cost of the building and its equipment is placed at $2,368,000.

Inventions in Glass.

A Washington correspondent, in his rambles through the Patent Office, discovered some curious inventions in glass, which he communicated to the Philadelphia Times.

Among these is a glass coffin, which is guaranteed proof against decay and rats. So long as no deliberate attempt is made to smash it, it ought to last forever. Another contrivance is a staircase made wholly of glass, steps, landings and newel post being all of that material. Yet another is a glass barrel. But, perhaps, the most remarkable invention of the glass man is a billiard table of glass.

The day may yet arrive when people will live in glass houses. A patent has been secured by another inventor for glass bricks of a peculiar pattern. The material of which they are composed being a first rate non-conductor, these bricks will keep the cold out of a dwelling built of them, while admitting the light. It is claimed they will exclude noise, being hollow. Furthermore, the inmates of a glass house need not be afraid of being under too close observation by neighbors, inasmuch that it is not requisite that the bricks shall be transparent. They may be of opaque ground glass or of any color that may be suitable for decorative effect.

Thus, before many years have passed, it may be considered the height of luxury to occupy a dwelling of glass. Glass bricks, of course, are expensive. People who live in glass houses will be able to afford to wear clothes of glass. That sounds like nonsense, but the fact is that beautiful and most delicate fabrics are made out of spun glass. Nearly twenty years ago there was shown at the Centennial Exposition, in Philadelphia, a bonnet composed entirely of glass. It was a love of a bonnet. The flowers on it were glass, and so were the ribbons, which looked like the finest satin. The patentee of this process describes it as suitable for the manufacture of neckties, shawls, table covers, etc.

In fabrics of this kind a very fine quality of glass is used. It is spun in threads of exceeding delicacy, and of these several colors may be produced at the same time. They are woven in a loom of ordinary pattern. Anybody may observe that a thin sheet of glass is somewhat elastic. The threads employed in weaving are of such fineness as to be perfectly pliable and not at all brittle. With a gown of glass would naturally go a pair of glass slippers.

A Pittsburg man named Smith has invented a process for making glass slippers in moulds. They would not do very well for dancing. There is no reason why a glass gown should not be woven of iridescent glass, so that the wearer would look like an animated rainbow on a ball room floor—one dazzling shimmer of ever-changing hues. Until recently the manufacture of iridescent glass was set down in the list of the lost arts. But in 1878 it was rediscovered, and now it is a common commercial article. It is made by exposing the melted glass to the vapors of salts of sodium. At the Metropolitan Museum of Art, in New York City, are exhibited great numbers of bottles, plates and other articles of glass which were made and used long before Christ was born. They were dug up in Cyprus and elsewhere. Many of them have a beautiful iridescence, but it is the result of decay. Glass will rot like anything else, and decay has split the structure of this ancient glass into laminæ, or flakes, which interrupt the light so as to produce brilliant red, green, purple and other rainbow colors.

The window blinds of the glass house of the future will be of glass, of course. That is another patent, and the inventor suggests that such blinds may be made of whatever colors are desired. Baby in the nursery, perhaps, will play with glass building blocks and at a suitable age he will receive a Christmas gift of a pair of roller skates with glass rollers. Both of these ideas have been patented. When he is old enough to go fishing, he will not dig worms in the garden, but will be provided with artificial bait in the shape of a hollow minnow of glass, coated on the inside partly with a solution of gold or silver and partly with a luminous paint.

Glass bedsteads may be proof against lightning and bugs, but it is hardly to be expected that glass houses should be free from mice. The inmates could hardly do better than employ glass traps for the capture of such vermin. The great advantage of the glass mousetrap, according to the statement of the inventor, is that "if one mouse enter the trap he may be seen by others who chance to go that way, and they will be inclined to join the one inside, especially when they observe that he is nibbling a choice morsel." Up to date the glass mousetrap has not made itself popular, notwithstanding the important arguments in its favor, and of most of the other devices described it is unfortunately true that they have not proved profitable to the persons who contrived them. This remark, however, by no means applies to the glass lemon squeezer, which is already a familiar household utensil. The inventor of it is said to have sold his rights for $50,000. One of the most remarkable inventions in glass, by the way, was that of a Venetian named Joquin, in 1656. He noticed that the scales of a fish called the bleak gave a milky hue to the water, and that glass beads dipped into such water looked like pearls when dry. Subsequently the idea was conceived of making hollow beads of glass and lining them with the peculiar substance from the scales of the fish, and it is in this way that the so-called Roman pearls are now manufactured. It is to this substance that the iridescence of the scales of many species of fishes is due.

The Water Trees of Australia.

Those who go out to grapple with the dangers, the hardships, and the mysteries of the Australian desert regions should, above all things, instruct themselves in bush lore. It has happened more than once that in these dread torrid wastes the body has been found, lying beneath a tree, of some poor wanderer who had died from the lack of water, even while there was within a few inches of him a plentiful supply.

In all the unwatered regions of Australia are to be found "water trees," trees which actually provide a supply of water to those who know where and how to look for it. The most reliable of the water trees are the water mallers, or group of trees, including the Eucalyptus microtheca, which form a part of the terrible maller scrub. Outside of these, the currajong, the desert oak, the bloodwood, and several varieties of the acacia are water-bearing trees.

I shall not soon forget my first introduction to a water tree. I was in the northern territory of South Australia, and I was making my first journey through the desert in company with a friend who was a well-informed bushman. It was toward the end of the day, and as we had been detained for several hours owing to an accident, we had still fifteen miles to travel. The water bag had been drained hours before, and in that dreadful desert our sufferings had already become intolerable. Suddenly my friend plunged his spurs into his weary horse and dashed at full gallop toward a tree some fifty yards off, shouting to me to follow. Flinging himself from his saddle, he clawed with his fingers the sand at the base of the tree, and presently laid bare one of its spreading roots. This was torn from the earth to the length of about six feet, and breaking off a piece about a foot and a half long, my companion, signing me to follow his example, applied one end of the piece of root to his parched lips and elevated the other end. I followed suit, and to my indescribable joy a cool refreshing draught of water rewarded me. The one root amply sufficed for our wants. There was some ten or eleven left, enough to have satisfied a dozen thirsty men. Some of the water we drained into our water bags. It was clear and cool, but after standing for a few hours I noticed that it became discolored.—Introduction.

Another Great Mill in Fall River.

The Fall River Iron Works Company was chartered in 1824, and then received the right to make almost anything. For a long time the company manufactured the products of iron ore and made some cotton cloth When Mr. Borden purchased the property, he turned all the mills into cotton mills.

Work on Mill 4, which was recently dedicated, was begun on May 14, and it is expected that its machinery will be in full operation by New Year's. The mill is 372 feet long, 165 feet wide, and four stories high. It has a capacity of 80,000 spindles and has 2,388 looms. The motive power will be furnished by a triple expansion, tandem, compound Corliss engine of 3,000 horse power, said to be the largest horizontal engine in the world. With the new mill the plant of the Fall River Iron Works Company now includes four mills, having a floor surface of 840,000 square feet; four triple engines capable of developing 9,000 horse power; forty-five horizontal boilers, the fourth highest chimney in the world, 265,000 spindles, 7,700 looms, and 377 cards. The capacity of plant will be 50,000 pieces of cloth a week, and 2,700 hands will be employed. This does not include the 750 employes in the print works.

MODERN WRESTLING.

The spectacle of wrestling has an extraordinary attraction for most people, not only in the world of laborers, who crowd into the booths of wrestlers at fairs, but also for the more select and refined habitues of circuses and the large theaters of curiosities. Just as sure as one of the latter organizes a wrestling match, other establishments will immediately imitate it, and the walls of Paris will be covered with posters announcing encounters, matches and challenges between more or less celebrated wrestlers. It is like an epidemic that returns périodically at intervals of two or three years.

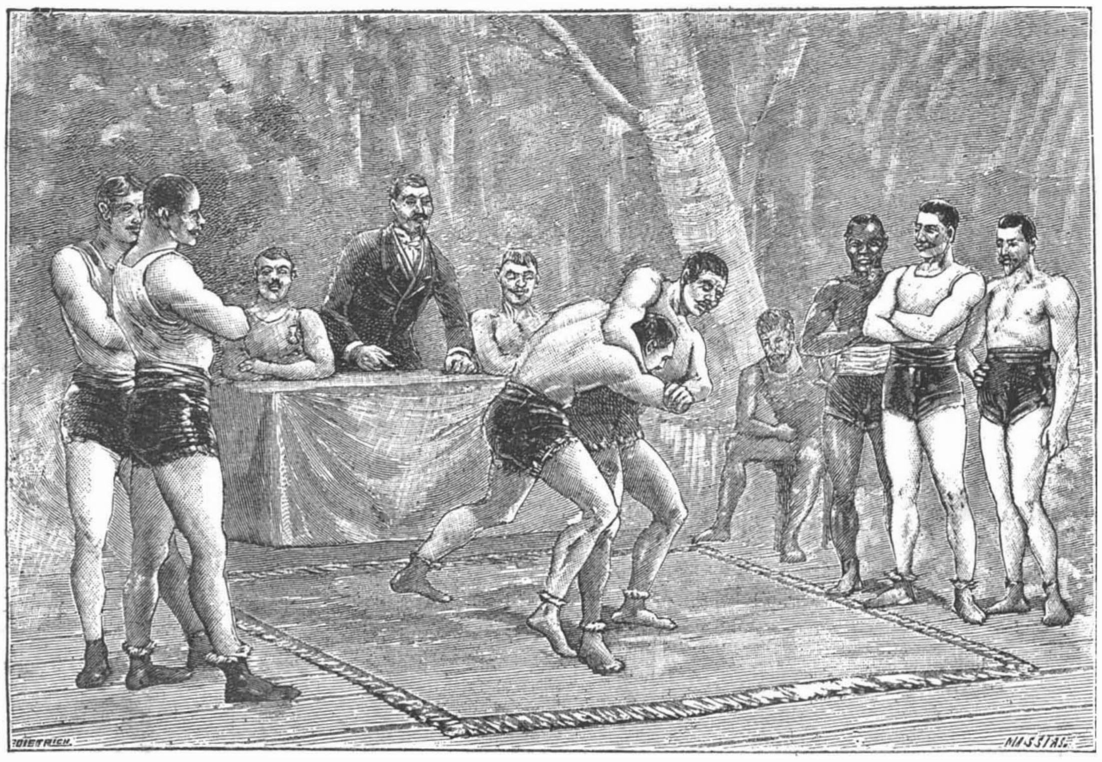


Fig. 1.—A WRESTLING MATCH.

A few years ago an epidemic of this kind broke out at Paris, and this is perhaps a good occasion, although somewhat retrospective, to speak of wrestling and wrestlers. When we view a wrestling match succeeding a fencing bout on the same evening, we remark a great analogy of execution. Each stroke in wrestling, as in fencing, comprises in general three parts: the attack, the parade and the return. But while in fencing such or such an attack calls for such or such a parade, the kind of parade cannot, in wrestling, be thus regularly foreseen, as it depends much upon the play of the adversary. Each wrestler, in fact, naturally adopts a certain number of strokes and parades appropriate to his physical nature. A large, stout, heavy wrestler will seek the stroke in which he can crush the adversary under his weight; in the parades, he will resist by his mass, his inertia. A small but stout wrestler will seek the strokes from beneath, the different kinds of holds in which he will be able to cause his adversary to lose his balance and be thrown down. A slim but very supple and nimble wrestler will be able to avoid all dangerous grips. If he falls, he will prevent his shoulders from touching the ground by forming the bridge. He will often prove the conqueror of an opponent who possesses a much greater physical strength.

After one has witnessed several wrestling matches, he will discover in professionals a true science of wrestling that is the result of instruction received, of study, and especially of the experience acquired by long practice. In rural wrestling, on the contrary, the chance opponents contribute merely their strength and willingness. They fence, so to speak, like novices who are holding a foil for the first time. There are masters of wrestling, professors fond of their art, just as there are masters of fencing. They are generally very proud of their science, and continue the traditions transmitted by the most celebrated athletes. There are even rival schools, such as those of Toulouse and Bordeaux, just as there are schools of fencing, such as the Italian and the French.

If we witness a wrestling match, we shall be able to account for the succession and concatenation of the attacks, parades and returns.

Upon entering the booth of itinerant wrestlers, we generally see a sort of central arena around which are benches rising one above another that seat a noisy crowd. The arena is covered with a thick stratum of sawdust. Around stand the wrestlers and amateurs. The amateurs are those who have accepted the challenge of one of the wrestlers at the door. Such challenge is symbolized by a fencing or boxing glove. We shall see further along that these amateurs are in most cases confederates in the pay of the leader of the troop. In the arena, this leader, otherwise called the master of the booth, serves as umpire (Fig. 1). He is, as a general thing, an old wrestler. He selects the couples, encourages the combatants and evokes the plaudits of the spectators when one of the two adversaries is conquered (Fig. 2).

In the arenas of circuses and theaters, or in the bouts of amateurs, the organization of the wrestling match is more complicated and there is more stage setting, so to speak. The umpires and the president of the match occupy a platform. To the left and right stand the wrestlers—professional or amateur. The upper part of their body is either naked or clothed with a sleeveless shirt that allows the muscularity of their arms to be seen. The arena is covered with a thick carpet designed to deaden falls. The president calls up the wrestlers, either professional against professional, professional against amateur or amateur against amateur, and the bout begins. Each match begins with a salute. This, between the adversaries, is a sort of pledge that the wrestling will be done without hatred, and will be loyal and frank.

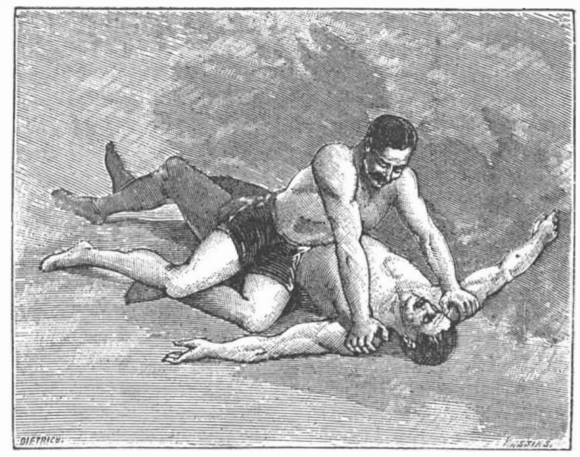


Fig. 2.—THE CONQUEROR.

For the salute (Fig. 3, No. 1) the adversaries, placing themselves face to face at a distance of four or five paces, walk toward each other in obliquing a little to the left, and at the moment of passing, take each other by the hand without interrupting their walk. They advance two steps further, and then, suddenly turning about, fall into guard. In this position, each wrestler prepares to attack his adversary, and, on his own part, to prevent a grip that would be unfavorable to him.

A corpulent wrestler, for example, will stand with his left foot forward, his right behind, his body vertical, his elbows close to his body, and his arms slightly forward. A smaller or a slimmer wrestler will stand more inclined, in order to give less hold and to avoid, for example, the front hold stroke. When the match is serious, the preliminaries of the attack are sometimes very lengthy.

The wrestlers make a feint of seizing each other by the wrists, or of taking each other by the arms or head, and they turn around one another, each avoiding the grasp of the adversary and meditating an attack. But, all at once, one

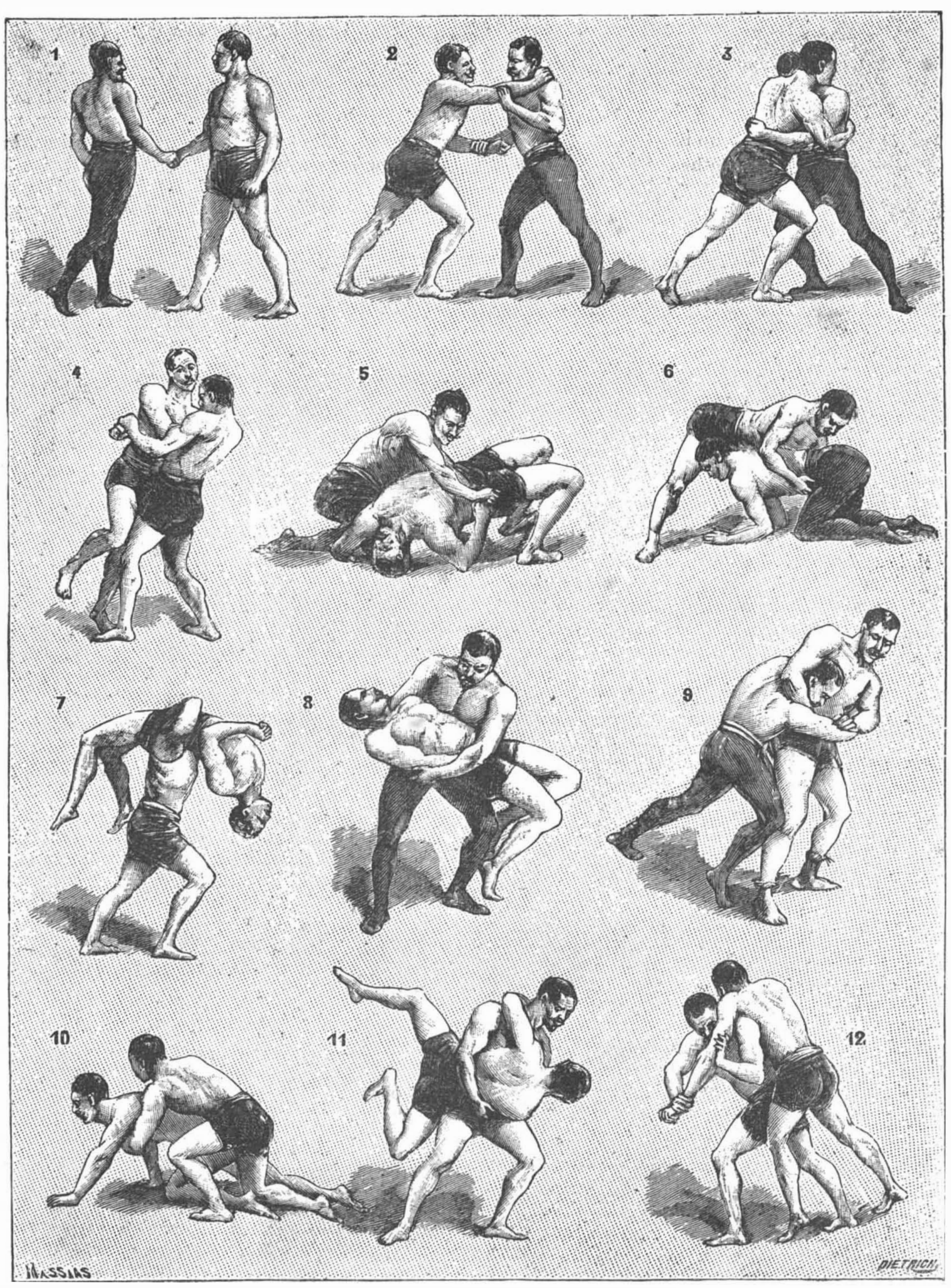


Fig. 3.—THE STROKES OF WRESTLING.

1. The salute. 2. The attack. 3. The hold. 4. The left hank. 5. The bridge. 6. The backward hold. 7. The swing and throw. 8. The left hank stroke (second time). 9. Holding the head in chancery. 10. The back hold. 11. The buttock. 12. A shoulder stroke.

of the wrestlers, profiting by a moment in which his adversary has unguarded himself, will rush upon him and attack him by the front hold stroke. In this stroke, the wrestler passes his two arms around the body of his adversary, and, clasping his hands to gain more strength, endeavors to make him bend the loins, to draw him upon his breast, and then, lifting him from the ground so as to make him lose foothold, to throw him forward, so that, in falling heavily upon him, he may make his shoulders touch the carpet. But, probably, things will not proceed in this way, and the attacked adversary will resist. If he has not been able to avoid the hold, he will respond (according as he has one arm or both in the grip of his adversary) by a hold, and the two wrestlers will find themselves breast to breast head to head, and arms locked behind each other's back (Fig. 3, No. 3).

The two wrestlers might remain in such an embrace for a very long time, each waiting for his rival to weaken in the loins or in the grip of his arms. In rural wrestling, adversaries are seen to remain thus immovable for from five to ten minutes, a length of time that seems interminable to spectators. Professionals abridge such time by a return. As a general thing, this will be by a hank stroke (Fig. 3, No. 4). In this case, the wrestler, profiting by the fact that his adversary has one of his legs, the left for example, advanced against the interior of his own, will try to make him pivot and roll upon his hip, so that he may lose his equilibrium, turn upon his side and fall upon his back. This is the left hank stroke (Fig. 3, No. 4). Will the wrestler thus turned upon his back touch ground with his shoulders? It is not very probable. If he is supple and nimble, he will hasten to form the bridge. The bridge is a parade that is seen employed at every instant in wrestling matches. In order to play this stroke, the wrestler, at the moment that he feels himself falling upon his back, reverses his head, throws his elbows and forearms backward, and bends his legs under him. Through this sort of bridge with five pillars he will always endeavor to keep his shoulders away from the ground (Fig. 3, No. 5).

The first wrestler will probably try to crush the adversary who forms the bridge under his weight, and will likewise endeavor to make him lose his equilibrium by pushing his head and arms from under him. In order to avoid the danger, the second wrestler will take advantage of the first favorable moment for quickly turning over so as to bring himself upon his hands and knees (Fig. 3, No. 6). The first wrestler, who is likewise upon his knees, since he is endeavoring to crush his adversary who formed the bridge, will then be able to make one of the finest attacks of wrestling—the backward hold. In this stroke, the wrestler, seizing the adversary's body with his arms (Fig. 3, No. 6), lifts him, places him upon his shoulder (Fig. 3, No. 7), and, after swinging him like a load, pitches him forward, trying by this fall to stun him and make him land upon his shoulders. It is a terrible stroke, and one of great effect.

Another stroke, which likewise borders upon acrobatics, is as follows: We have seen that in the preliminaries to a match each wrestler makes a feint of seizing the head of his adversary. If, by chance, the latter does not know how to avoid the attack, he will be submitted to a singularly painful experience. The wrestler, having succeeded in surrounding the head of his adversary with his arm, turns around and throws him upon his back, and then stooping, and ever pulling upon the neck of his victim, throws the latter head over heels in front of him. This somersault ends in a fearful fall upon the back. It is a stroke that is often employed by a professional wrestler with an amateur whom he wishes to discourage. The unfortunate individual, half choked, his body dislocated by the traction to which it has been submitted, and stunned by the somersault, falls heavily upon the ground and is in an unfit condition to react or seek a parade.

There are a large number of other attacks that we cannot describe here, but an enumeration of which will be found in manuals upon the subject of wrestling.

The name of such attacks indicates approximately their mode of execution: The hank stroke (Fig. 3, No. 8); getting the head in chancery (Fig. 3, No. 9); the buttock (Fig. 3, No. 11); the shoulder stroke (Fig. 3, No. 12).

Then come the parades, three in number, which consist in pressing the front, back or side of the adversary's neck strongly with the forearm, so as to prevent him from breathing or to dislocate his vertebral column, and, in either case, to make him let go his hold.—La Nature.

Fruit as Medicine.

Why for ages have people eaten apple sauce with their roast goose and sucking pig? Simply because the acids and pectones in the fruit assist in digesting the fats so abundant in this kind of food. For the same reason at the end of a heavy dinner we eat our cooked fruits, and when we want their digestive action even more developed we take them after dinner in their natural uncooked state as dessert. In the past ages instinct has taught men to do this; to-day science tells them why they did it, and this same science tells us that fruit should be eaten as an aid to digestion of other foods much more than it is now. Cultivated fruits, such as apples, pears, cherries, strawberries, grapes, etc., contain on analysis very similar proportions of the same ingredients, which are about one per cent of malic and other acids, and one per cent of flesh-forming albuminoids, with over eighty per cent of water.

Digestion depends upon the action of pepsin in the stomach upon the food, which is greatly aided by the acids of the stomach. Fats are digested by these acids and the bile from the liver. Now, the acids and pectones in fruit peculiarly assist the acids of the stomach. Only lately even royalty has been taking lemon juice in tea instead of sugar, and lemon juice has been prescribed largely by physicians to help weak digestion, simply because these acids exist very abundantly in the lemon.—From the Popular Science Monthly.

Discovery of a Great River in Canada.

The Toronto Evening Mail says that Dr. Bell, of the Geological Survey, who has just returned from a trip to James Bay, reports having discovered a great river in the north, as well as many other interesting things. He left about the end of June. The route was direct north from Ottawa, across the height of land to Rupert's house on James Bay, by the most direct water course. The trip by water course was nearly 800 miles. Five hundred miles of this route, or the entire distance from the height of land to James Bay, was through an altogether unexplored region unknown to any one but the Indian hunter. Shortly after they crossed the height of land the party followed an unknown river, which gradually widened until it assumed a great size. They followed this river to James Bay, which forms the southern extremity of the great Hudson's Bay. The river had three large branches, one of which has its source north of Three Rivers, another in the Lake St. John region, and the third near Lake Mistassini. The new river, for which the Indians have no name, is much larger than the Ottawa, and Dr. Bell affirms it to be the sixth of the great rivers of the world, five of which are to be found in Canada. Its average width is considerably more than a mile, and it has expansions many miles in width. It flows through a low level clay country, is very deep, and may be called a new Nile of the north. The river is 500 miles in length, and great stretches would be navigable for steamers. Toward James Bay there are successions of great rapids, which render it useless as an inland route. These rapids cannot be ascended except with great difficulty. The river banks are very heavily wooded with pine, spruce, tamarack, balsam, and white birch. The primeval forest extends along the whole length of the river. Fire has not wrought any destruction yet. Until the height of land is crossed Dr. Bell says the soil is sandy, but having crossed the watershed, the land is of a rich clay loam, well adapted to agricultural purposes. By experiments wheat and barley have been grown in districts of the same latitude. Returning, the party crossed James Bay from Rupert's house, and back by Moose and Missineiba Rivers, till they reached the Canadian Pacific Railway, north of Lake Superior.

RECENTLY PATENTED INVENTIONS.

Electrical.

CONVERTING OR TRANSFORMING CURRENTS.—Paul Boucherot, Paris, France. This invention provides a method of transforming electric currents to obtain constant effective voltage, affording a current of constant intensity where a periodic electromotive force of a constant effective average value is given; also for obtaining a constant effective difference of potential where a current of constant effective intensity is given. Any kind of apparatus is employed having capacity and self-induction, with coefficients of appropriate values, and the function of the apparatus is similar to that of a transformer, except that instead of the electromotive force being in the secondary circuit, it is the current which is constant, irrespec ive of the resistance.

SNAP SWITCH.—Joseph H. McEvoy, Waterbury, Conn. This invention relates to switches in which the contact between terminals is made and broken by a sudden snap-spring action, to make a quick and positive connection and avoid the making of arcs. Combined with an intermittently rotating switch bar, a winding key and a spiral spring, are two disks laid flat against each other and connected loosely by a slot and pin, one of the disks being connected to the switch bar and having stop projections and the other disk being connected to the winding stem and having cams corresponding to the stop projections, while a detent bearing against the stop projections is operated upon by the cams. The switch may be cheaply made of punched pieces and quickly assembled.

Railway Appliances.

SAFETY AND EMERGENCY BRAKE.—Felix McDermott, Worcester, Mass. This improvement is more especially designed for use on street cars, and provides for brake levers under the car platform, extending transversely, and carrying shoes which are pressed outward into braking contact with the rails. On the lower end of a rod actuated by a hand wheel is a cam engaging the pivoted inner ends of the brake levers, to force the latter outward, another cam returning or releasing the levers.

Mining.

CONCENTRATING GOLD.—Charles Sill and William Wright, New York City. For quickly and economically separating the largest possible quantity of gold from sand or earth, these inventors arrange a concentrating drum above an amalgam table over which rollers move in advance of the drum, there being an operative connection between the drum and rollers to cause the latter to reciprocate on the table when the drum is rotated. Means are provided for concentrating any gold that may escape from the first concentrating process.

Mechanical.

PUNCH. — Charles Hood, Puyallup, Washington. This is a tool designed chiefly for sheet metal, to be fitted in the bench plate of a tin shop after the manner of shears, and to be operated by hand. It comprises two parallel plates between which is a lever handle, the plates having jaws in front between which a female die is adjustably held while a punch lever carries a die punch fulcrumed between the plates, a handle lever being connected to the punch lever by intermeshing teeth.

COMBINATION TOOL.—Henry C. Caldwell, Lancaster, N. Y. This tool comprises a pair of plier jaws provided with a hammer poll and a hatchet blade, one handle being formed into a screw driver bit and the other into a claw, while the plier jaws have projecting portions forming grips with serrated faces adapted to serve as a wrench, a hand vise, or a pipe tongs. This multiplicate tool is neat in design, takes up but little room, and may be produced at a moderate cost.

Agricultural.

THRASHING MACHINE. — Jesse Morningstar, Pettisville, Ohio. This improvement provides simple means whereby the straw and grain will be fed from the cylinder or concave to a reciprocating floor, in connection with which are operated rakes having substantially parallel movement with the floor in both directions. When the rakes move in a direction to feed the straw their teeth are above the upper surface of the floor, but when they move in a direction to receive the straw their teeth are withdrawn from the floor and its upper surface is free, or that portion of the surface is free through which the rakes pass.

HAY LOADER.—August Westman, Tracy, Minn. In this machine a revolving cylinder is employed in connection with a carrier, the hay being gathered by the cylinder and elevated to the wagon above the carrier, the invention providing an improved construction of the finger cylinder, which is rotatably mounted on a wheeled frame and has longitudinal slots in which are located finger-carrying shafts. The machine is simple, inexpensive, and durable.

Miscellaneous.

DUMPING SCOWS. — Scott Webber, Pigeon Cove, Mass. For deck-dumping vessels this invention provides an improved launching table for dumping on both sides simultaneously, thus insuring an even rising of the vessel and preventing careening. Opposed platform sections have each overlapping recessed brackets and a longitudinal separable sectional locking rod is suspended freely above the brackets to be lowered into and raised out of all the recesses when rotated, or to have one or more of its sections when uncoupled similarly operated to release the corresponding platform sections.

GATE. — Henry P. Talbot, Harrisburg, Oregon. This gate is designed to be strong, light and inexpensive, especially adapted for farm and stock yards, and it may be opened and closed by one in a vehicle or on horseback as readily as by one afoot. The gate slides in a supporting frame where an operating wheel is journaled with attached lever, a second wheel and attached pulley being also journaled in the frame, and a cable being passed around the operating wheel and the pulley, while a cable connected to the front and rear of the gate is also passed around the pulley, and means are provided for operating the lever of the operating wheel from either side of the gate.

SHUTTER FASTENER. — Charles Barbarow, Paterson, N. J. This is a simple device for easily opening and closing a shutter and fastening it in the open or closed position. It comprises a shank adapted to pass through the shutter and having a headed outer end arranged to engage a spring-retaining device to hold the shutter in its open position, while a catch engages a projection on the sill to hold the shutter closed.

CURTAIN OR BLIND FIXTURE.—Thomas U. Walter, Huntington, West Va. This improvement is designed to facilitate the ready adjustment and secure holding of a curtain or inside blind without the use of the coil spring and spring-compressing devices heretofore commonly employed, a slight pressure on the rod or bar at the lower end of the curtain releasing the catch member and freeing the curtain or blind to permit its free movement. Guideways of the sash frame have a rack member, and the pull rod of the spring-returned curtain has a catch mechanism which is substantially automatic in its action, being operated by the ordinary pressure or pull used in raising or lowering a curtain or blind.

BUTTON HOLE MOISTENER.— Charles Miller, New York City. For readily moistening the starched surface around the button hole of a garment to facilitate buttoning, this inventor provides a little implement having a guide lip to enter the button hole, while in immediate proximity thereto is a reservoir with apertured head, the reservoir containing an absorbent material, the moisture of which is pressed through the openings of the head.

BELT SLIDE AND SKIRT SUPPORTER.—Louis Sanders, Brooklyn, N. Y. The body of this slide has hooks adapted to support a skirt, and the tongue has a spur or pin which enters the belt when the tongue engages the keeper or body of the slide, holding the slide in a given position on the belt and preventing the belt from buckling up within the slide.

STAIR CARPET FASTENER.—Milton T. J. Ochs, Allentown, Pa. This improvement consists principally of two plates or rods adjustably and pivotally connected to each other and having their outer ends adapted to engage the tread and the nosing of the stairs to fasten the carpet in place. The device is easily operated, its construction being on the toggle-link principle, and it is cheaply made.

CONDENSED MILK CAN.—Constance A. Smith, Brooklyn, N. Y. This can has a bottom aperture closed by a spring-pressed slide moving in guideways on the bottom of the can. The can is of ornamental appearance and is designed to facilitate serving measured quantities from the can without dipping or pouring, as now practiced.

PAPER BOX.—Edward E. Pinkerton, Sioux City, Iowa. This is an improvement on a formerly patented invention of the same inventor providing a box that is cheap to manufacture and in which the several heads readily interlock to securely fasten the parts together. The blank is cut or stamped from a single sheet of material.

SPACING GAGE.—James H. Foster, Meriden, Conn. This is a device designed to facilitate hand printing with ready made characters, enabling the operator to place the characters in proper position to form accurately spaced and aligned words.

Designs.

DISH.—Hippolyte J. M. P. La Bastide, Limoges, France. The cover and body of this dish are in what is known as the Lafayette shape, the handles each involving a curled leaf figure and a curved stem figure, and there being minor surface decorations of the cover and body.

PENCIL CLASP.—William E. Wood, Portland, Oregon. This is a clasp for attaching a pencil to a pocket, the device being simply formed of a single piece of spring metal.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

ELECTRICITY FOR EVERYBODY. Its nature and uses explained. By Philip Atkinson, A.M., Ph.D. New York: The Century Company. 1895. Pp. 240. 12mo. 100 illustrations. Price $1.50.

This is avowedly a book for popular reading. The author has kept constantly in mind the difficulty of his subject and has striven to divest his book of the confusing technicalities of the science. There is no sacrifice of strict scientific accuracy, but as little detail as possible has been included. Some of the latest applications of electricity, as electrical heating and cooking, are described.

VITRIFIED PAVING BRICK. By H. A. Wheeler E.M. Indianapolis: T. A. Randall & Company. 1895. Pp. 84. 12mo. Price $1.

This is a timely publication in view of the present active discussion on the subject of good roads, especially as it is devoted to a class of pavements that seem to have a great future in this country. They are now in use in about four hundred cities and towns, yet vitrified brick pavements do not seem to be as well known as their merits deserve. The advantages of this form of pavement are smoothness, ease of traction, freedom from mud, moderate noise, small expense of repairs, and comparatively moderate cost of construction. The book goes into the details of manufacture, testing and paving. The tables are of the utmost value.

COMPEND OF MECHANICAL REFRIGERATION. By J. E. Siebel, Director Zymotechnic Institute, Chicago. Chicago: H. S. Rich & Company. 1895. Pp. 256. 16mo. Price $2.50.

A comprehensive digest of applied energetics and thermodynamics for the practical use of ice manufacturers, cold storage men, contractors, brewers and others interested in the application of refrigeration. This is a very important contribution to the literature of a subject which until recently has been very inadequately treated. The tables and formulæ are of great practical value, the subject of thermodynamics, refrigeration in general, the ammonia compression system, ice making and storing, cold storage, brewery refrigeration, the absorption system, other compression systems, installation, etc., are treated in turn. In the appendix is a bibliography of literature on thermodynamics, etc., which will prove very valuable. The work deals with the principles involved rather than the features of individual machines.

OLD SOUTH LEAFLETS. Sir Henry Vane's Defense, 1662; A Free Commonwealth. By John Milton; Cromwell's Second Speech, 1654; Pym's Speech against Strafford, 1641; Ship Money Papers, 1654; Sir John Eliot's Apologie for Socrates; Letters of Hooper to Bullinger; The English Bible. Boston: Published by the Directors of the Old South Work, Old South Meeting House. 12mo pamphlets.

THE PRACTICAL APPLICATION OF DYNAMO ELECTRIC MACHINERY. By C. K. MacFadden and W. D. Ray. Chicago: Laird & Lee. 1895. Pp. 167. 16mo. 38 illustrations. Price $1.

There are many good books on the various branches of electrical work, but they are often of such a technical nature as to bar the uneducated reader from obtaining much benefit from them. The close study of this book will place the average beginner on such a foundation as to make the other more complete electrical books more easily understood. It will prove of particular value to dynamo tenders and motor men.

COMPRESSED AIR. Practical information upon air compression and the transmission and application of compressed air. By Frank Richards. New York: John Wiley & Sons. 1895. Pp. 203. 12mo. 23 illustrations. Price $1.50.

Owing to the general scarcity of practical information about air compression and the uses of compressed air and the wide diffusion of misinformation and prejudice upon this subject, the work is of special interest. One of the most interesting features of the work is the last chapter, which gives a remarkable list of the various applications of compressed air. The list includes only the direct applications of compressed air to specific uses, and not its employment in an air motor, or where it takes the place or does the work of a steam engine or other power developer. Great attention is paid in this work to economical air compression and the commercial aspect of the use of compressed air.

DICK AND JACK'S ADVENTURES ON SABLE ISLAND. By B. Freeman Ashley. Chicago: Laird & Lee. 1895. Pp. 312. 12mo. Price 50 and 75 cents.

HOW TO DRAIN A HOUSE. By George E. Waring, Jr., C.E. New York: D. Van Nostrand Company. 1895. Pp. 223. 16mo. 33 illustrations. Price $1.25.

This is the second edition of a book of practical information for householders, with annotations bringing the work up to date. It treats of house drains and health, foundation and cellar, foul drainage, plumbing, the sewer gas question, traps, the soil pipe, sewage disposal, etc. The first edition of the work was very favorably received.

A LABORATORY COURSE IN EXPERIMENTAL PHYSICS. By W. J. Loudon, B.A., and J. C. McLennan, B.A. New York: Macmillan & Company. 1895. Pp. 302. 8vo. 50 illustrations. Price $1.90.

The book contains a series of elementary experiments specially adapted for students who have had but little acquaintance with the higher mathematical methods. There is also an advanced course of experimental work in acoustics, heat, and electricity and magnetism which is intended for those who have taken the elementary course. The experiments seemed to be fully explained, but in many cases they are supposed to be tried with the elaborate and expensive apparatus of Koenig and other makers—apparatus which the student does not always have at hand.

LADD'S DISCOUNT BOOK. Compiled and edited by William J. Ladd. Unpaged. 8vo. Price $3. Double indexed edition $4.

This book contains more than one hundred thousand calculations. The tables will be found very complete and will prove of value for finding the net cost of goods and for making lists for specified discounts and for making discounts for specified lists, also for comparing prices, etc. A few days' use by buyer, price clerk, or manufacturer, or any one who has to handle the unwieldy discounts of to-day, will verify the claim of the compiler that the book is accurate, rapid, and withal practical.

THEORY AND PRACTICE OF THE SIZING OF PAPER. New York: The Arabol Manufacturing Company. 1895. Pp. 32. 12mo.

SIMPLE METHODS FOR DETECTING FOOD ADULTERATION. By John A. Bower. London: Society for Promoting Christian Knowledge. 1895. Pp. 118. 16mo. 36 illustrations. Price 80 cents.

The experiments are simple, consisting for the most part of the application of simple chemical and microscopical tests as well as of specific gravity.

TABELLEN UBER DIE BLECHDICKEN UND DURCHMESSER DER FLAMMROHRE VON DAMPFKESSELN. Im Auftrage des Internationalen Verbandes der Dampfkessel- Ueberwachungs - Vereine. Herausgegeben von G. Eckermann. Hamburg: Boysen & Maasch. 1895. Pp. 26. 18mo. Tables. Price 2 marks.

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References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(6655) C. N. R. asks how to prepare brewer's yeast. A. Brewer's yeast is prepared as follows: 72 lb. unkilned malt and a handful of hops are gradually stirred in a clean tub containing 7 gal. of water of 170° F.; and to this 5½ gal. water of 200° are added. The tub is then covered tightly and left quiet. After some time it is cooled rapidly. This is accomplished by setting in cans filled with cold water. When the temperature of the mash has reached 70°, the tub is covered again and allowed to stand for some twelve hours longer, when 1½ gal. fresh beer yeast are to be stirred in. After another twelve hours have elapsed, pierce a hole in the layer formed by the husks of the malt and dip 3¼ gal. of the liquor beneath, then stir the whole up and dip 1¾ gal. from it (husks and liquor). This is the mother leaven, from which yeast can be generated all the year round by using it in the way described instead of the ordinary beer leaven. To the remainder in the tub add 5 gal. wort of 90°, and make use of it within two hours. The mother yeast also must be used the same day for fermenting another portion.

(6656) E. J. B. says: Can you inform me how to preserve plants with their natural colors? A. A recent improved receipt for preserving plants with their natural colors is to dissolve 1 pint salicylic acid in 600 parts alcohol, heat the solution up to boiling point in an evaporating vessel and draw the plants slowly through it. Shake them to get rid of any superfluous moisture and then dry between sheets of blotting paper under pressure in the ordinary manner. Too prolonged immersion discolors violet flowers, and in all cases the blotting paper must be frequently renewed. The novelty appears to be the salicylic acid.

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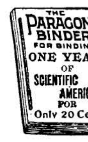

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